Industrial QUALITY CONTROL

SEPTEMBER, 1951 VOL. VIII, NO. 2

Addition of Special Technique—Subtraction in Computational Work Load
(For details, see page 7)

AMERICAN SOCIETY FOR QUALITY CONTROL

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Bearing race matching
Angle between bore and face
Diameter
Thickness
Bore center distance
Crank throw, eliminating all error due to diametral tolerance
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Bend
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Industrial Quality Control

Vol. VIII SEPTEMBER, 1951 No. 2

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A NEW DEPARTMENT "MANAGEMENT'S CORNER"

The methods of modern quality control have often been called "tools of management". Implied in this correct characterization is the fact that the manager is the customer to whom must be "sold" the methods of modern quality control.

Those who would promote the use of *any* new product soon find that it is not enough to be able to make the product: it is equally necessary that the product be marketed. The methods of quality control are no exception to this rule. They also must be marketed. The importance of this marketing problem and of other relations of quality control to management are so great that the Editorial Board at its Cleveland meeting authorized the establishment of a department for discussion of this and other quality control subjects of special interest from the management viewpoint.

The Board invited Dr. J. M. Juran to serve as editor of this new department and is pleased to announce his acceptance of this post and the activation of "Management's Corner" in this issue.

NEW EDITOR FOR THE PROBLEMS DEPARTMENT

A Problems Department was opened in the March 1950 issue of this journal and has been ably managed since under the editorship of G. Rupert Gause.

At the Cleveland meetings in May, Mr. Gause asked to be relieved of this responsibility, and the Editorial Board regretfully accepted his resignation, expressing its appreciation for the fine service he has rendered.

Paul C. Clifford was invited to serve as the new editor of this department. The Board is happy to announce his acceptance of this appointment and the activation of the Problems Department under its new editor in this issue.

GOOD NEWS

As of July 24, 1951, Si Collier reports a telephone conversation with Mrs. Walter A. Shewhart to the effect that Dr. Shewhart was then at home and getting along very well. He was at that time able to move about the house with the help of crutches. Progress toward recovery from the effects of his automobile accident in May has been slow but encouraging.

It is gratifying to know that Dr. Shewhart now appears to be off the critical list. All of us join in wishing him speedy and continued improvement.

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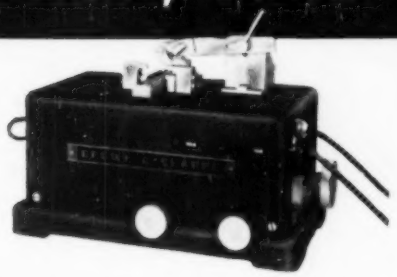

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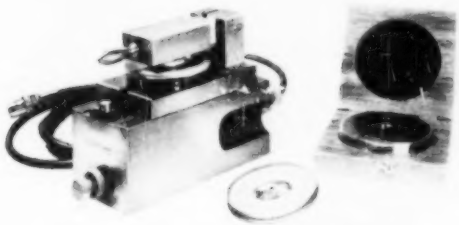

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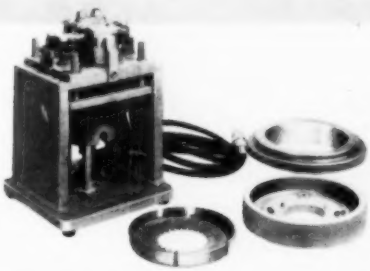

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The Tape Adding Machine Aids Statistical Calculations

VERNE H. RECKMEYER

Statistical Methods Specialist, Ansco Division of General Aniline & Film Corp.

SUMMARY

The use of a tape adding machine, in association with a computing machine, has been found to facilitate statistical calculations. The frequency of human errors is reduced by setting up a problem on tape, prior to the computing operation.

FROM TYPING TO COMPUTING

My secretary has had to do most of the computing in our office ever since we started statistical quality control. Back then, my boss told me, "Verne, look into this quality control business. See whether there is anything to it that we should have. And if there is, get it started." Well, that was a long time ago and Mrs. Park, my secretary, was a good secretary then. She typed my memos faultlessly and quickly; kept the office in meticulous order. Now, following our conversion to statistical quality control, she remains a secretary in name only. The typewriter has gone into semi-retirement. The filing cabinet holds loads of quality control forms and a box of quick-energy chocolate bars, along with the moldering remains of a once voluminous correspondence. The computing machine has become our tycoon. Its whirring thunder, directed by Mrs. Park's fingers, has almost completely dominated our activities.

This is the story of Mrs. Park's conversion from typing to computing; from an ordered life to one of frequent frustration. Our computing problems were back of it all. After we had gotten control charts and sampling plans well on their feet, the computing set in in dead earnest. The charts and sampling were fine. They told us when we were out of control. But the control technicians looked at the charts and often came to me with the wail, "Sure, we know it's out of control, but we can't figure out why! How about some help?" That called for correlations, regressions, analysis of variance and the whole hatful of analytical tricks. It also meant that we were really in the computing business.

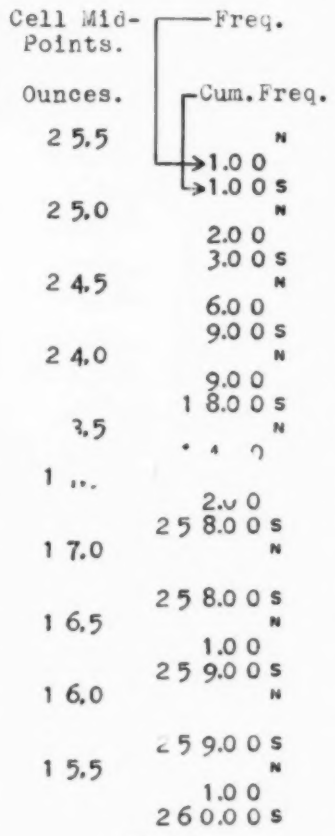

Figure 1

It was then that I concentrated on teaching Mrs. Park the mechanics of doing statistical calculations; variance analysis, correlation, and, as time went along, all the other basic techniques. She reacted favorably and, by making up peculiar little sets of notes, which only she could comprehend, mastered the techniques.

It was pleasing to be able to say to my associates, "Mrs. Park learned how to compute variance analysis two-way tables last week." Or, "She has done at least 25 correlations for me this week." But, nice as all that sounded—and actually was to the operation of the office—we had our troubles. Half-way through a problem we would get a screwy answer, one that could only mean an undetected computational error, somewhere earlier in the work. Fighting those computational errors was the fly in our ointment, the bane of our existence. We both made them. Who doesn't after several hours of steadily grinding a computer? We used cross-checks wherever possible as a routine precaution, but, as you all know, these are only partly adequate. Duplicate, independent computations were time-consuming and we preferred not to make them even though we knew that without such independent checks we ran the frequent risk of making errors and incurring the consequent cost of having to go through a computation as many as three times to catch and correct an error.

It was maddening and frustrating. It affected Mrs. Park and myself alike. I couldn't point the finger at her, because the next day she might well be able to point right back. We hung the statistician's prayer on the wall, "Lord, give me the strength to hit the right keys." It didn't help. We tried the ten o'clock and four o'clock fatigue angle, enlivening our spirits at the coke machine. It was nice, but it wasn't the answer. We resigned ourselves to a life of eternal vigilance against error.

ENTER: THE TAPE ADDING MACHINE

Then, as in all success stories, came the answer. We got a tape adding machine.* The tape has proved to be a real improvement for setting up our problems, replacing the conventional data sheet.

The tape technique also gives, along with the data, a lot of free an-

*Thanks to E. I. Small, statistical specialist of the Monroe Calculating Machine Co. He revealed the potentialities of the tape adding machine in a lecture to our Southern Tier Society for Quality Control.

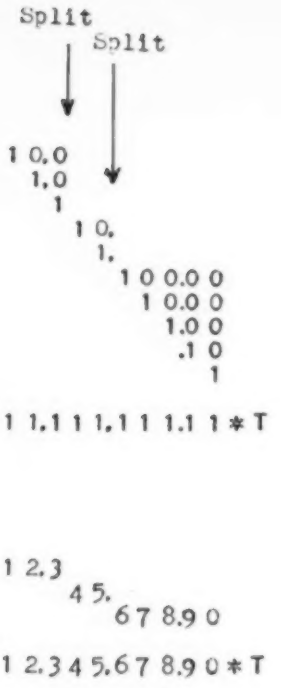

Figure 2

swers in the way of totals, sub-totals and group totals. We have found that it doesn't require any greater time to put our data on tape than on a data sheet. The sums on the tapes are then, conveniently, there to serve as checks when we next go to the computer for summing squares. Then, too, separate tapes can be made for different cells of data. These are easily shuffled and reshuffled into their appropriate groups for squaring and summing; for example, in a variance analysis job, with two criteria of classification and replication. Shuffling the tapes into separate groups greatly facilitated the ease with which we could compute. The possibility of reading wrong numbers from a table of data was minimized in using tapes. Mrs. Park says that manipulating the tapes is like playing a game of cards and that it is really fun.

After several months with our new tape adding machine, we are actually setting up the majority of jobs on tape. We are collecting yards of the stuff in place of reams of quadrille paper data sheets. Computational errors? Yes, we find them, but the occasions are becoming rare. We

X	Y
Abrasion Loss.	Hardness
372.	.45
2 6.	.55
175.	.61
154.	.66
136.	.71
112.	.71
55.	.81
45.	.86
221.	.53
166.	.60
164.	.64
113.	.68
82.	.79
32.	.81
228.	.56
196.	.68
128.	.75
97.	.83
64.	.88
249.	.59
219.	.71
186.	.80
155.	.82
114.	.89
341.	.51
340.	.59
283.	.65
267.	.74
215.	.81
148.	.86
5.263.	21.08*

Figure 3

seem to have prevented most of them from occurring through the conveniences inherent with data printed on tape.

Coming now to the more serious part of this article, we have found numerous instances where the tape is valuable in setting up for computation.

CUMULATING FREQUENCIES

Take, for example, the day-in-and-out job of calculating sigma from a frequency distribution of data. Grant's example(1) of the drained weights of contents of Size

X	Y
Abrasion Loss.	Hardness
372.	.45
2 6.	.55
175.	.61
154.	.66
136.	.71
112.	.71
55.	.81
45.	.86
221.	.53
166.	.60
1.642.	6.49s
164.	.64
113.	.68
82.	.79
32.	.81
228.	.56
196.	.68
128.	.75
97.	.83
64.	.88
249.	.59
2.995.	13.70s
219.	.71
186.	.80
155.	.82
114.	.89
341.	.51
340.	.59
283.	.65
267.	.74
215.	.81
148.	.86
5.263.	21.08*

Figure 3a

No. 2½ cans of tomatoes will illustrate. In this example, a frequency distribution was made of data from 260 cans. Having scored such a frequency distribution, the quick way to investigate normality of the weights, to determine the mean and the standard deviation, is by plotting the data on probability paper.(2) For this, we first get the required cumulative frequencies on a tape.

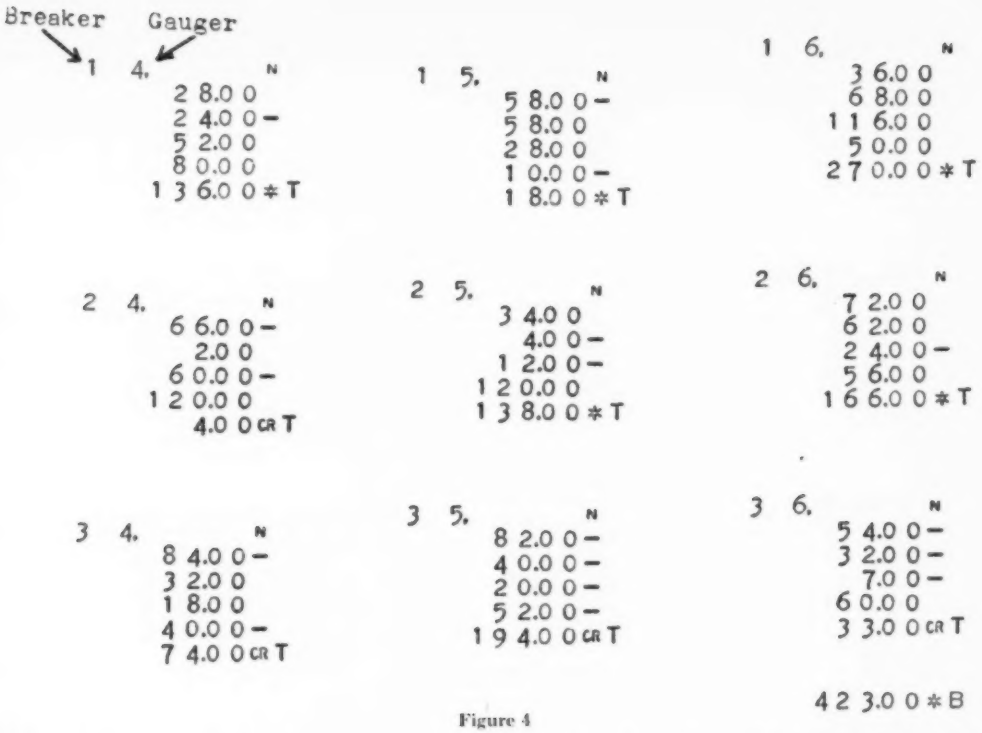

Figure 4

The observed frequencies of each cell group are added on the tape. However, immediately following each addition, the sub-total key is pressed, which records the frequencies cumulatively. Figure 1 illustrates the tape. The observed frequencies are in the right column; 1.00, 2.00, 6.00, 9.00, etc. The sub-totals "s" following each frequency, 1.00s, 3.00s, 9.00s, 18.00s, etc., are the cumulative frequencies. The last sub-total, 260.00s, is the total frequency. With the aid of a slide rule, these cumulative frequencies are converted to cumulative percentage frequencies as they are plotted on the probability paper. Quick? Convenient? And how!

Note that the left column on our tape lists the cell mid-point just previous to its observed frequency and cumulative frequency.

THE "SPLIT" DEVICE

This is essential for properly identifying the data and avoiding plotting errors. The separate column for such data was obtained by means of an ingenious device, called a split, which came free with our adding machine. The split divides the printing mechanism of the machine into sections, so that zeros will not print to the right of it unless numbers are also in that section. Our machine has two splits, installed by the local service man through a minor operation on the machine. These divide the keyboard into three sections. One split divides the keyboard at the middle, with the five keys to the right in one section and the five to the left in two sections. (See Figure 2.) This split is handy in correlation-regression problems. The entire left section is used for entering the X variable and the right section for the Y variable and the two are summed simultaneously. (See Figure 3.) For two and three digit numbers in each variable, the five digit capacity in each column is usually more than adequate. The splits, incidentally, have no effect on using the adding machine conventionally with its full ten-column capacity, as is shown by the totals in Figure 2. Some of the zeros don't print, when you cross a split, but Mrs. Park says she doesn't mind that.

The second of our two splits places the three keys at the extreme left into a section. These digits were the ones used to print the cell mid-point identifications on the tomato weight problem, Figure 1. They were entered with the non-add key, so as not to interfere with the totals.

These two splits have been useful for carrying identification on the tape when working with a problem in two variables. Figure 4 is a variance analysis problem where the first variable is identified in the first section split and the other variable in the second section split. The data are summed in the third section. The nine individual tapes in this job are thus completely identified.

The correlation-regression problem in Figure 3 is from Davies' example[3] on the physical properties

(1) "Statistical Quality Control," Eugene L. Grant.—McGraw-Hill. Table 7, page 52.
(2) Arithmetic probability paper. Codex Co. Form No. 3127.

(3) "Statistical Methods in Research and Production," O. L. Davies. Published by Oliver and Boyd. Second Edition. Revised. Table 6.1, page 119.

```
Breaker

1                    N
      1 3 6.0 0
        1 8.0 0
      2 7 0.0 0
      4 2 4.0 0 * T
2                    N
          4.0 0 -
      1 3 8.0 0
      1 6 6.0 0
      3 0 0.0 0 * T
3                    N
        7 4.0 0 -
      1 9 4.0 0 -
        3 3.0 0 -
      3 0 1.0 0 CR T

      4 2 3.0 0 * B

Gauger

4.                   N
      1 3 6.0 0
          4.0 0 -
        7 4.0 0 -
        5 8.0 0 * T
5.                   N
        1 8.0 0
      1 3 8.0 0
      1 9 4.0 0 -
        3 8.0 0 CR T
6.                   N
      2 7 0.0 0
      1 6 6.0 0
        3 3.0 0 -
      4 0 3.0 0 * T

      4 2 3.0 0 * B
```

Figure 4a

of 30 rubber samples. The X variable is abrasion loss, in grams per h.p. hour. The Y variable is hardness, in degrees Shore. In setting up problems, like this, our data are not usually found neatly tabulated in corresponding columns of a lab notebook or plant record sheet. Often they must be collected from numerous sources. Therefore, first putting data into orderly fashion on tape has proven well worth the time. No further data sheet is needed. The tape is more convenient than a data sheet, since it can be held in hand, at computer level, when summing squares. For lengthy correlation problems, we prepare tapes as in Figure 3a, with sub-totals every ten numbers or so. These serve, while summing squares on the computer, as a running check on the sums of X and Y.

VARIANCE ANALYSIS

Variance analysis problems with replication are especially well suited to setting up on tapes. In fact, the more extensive the replication, the more convenient is the tape over a data sheet. Figure 4 illustrates the point, although it is strictly junior size compared with the replication we sometimes run into and have to work with. The example cited is Davies' problem on the variation among "breakers" and "gaugers" in tests on a sample of Portland cement.[4] Nine tapes list the groups of four replicate tests for each "breaker" and each "gauger". Having set up the problem on these tapes, Mrs. Park proceeds to shuffle them into three piles belonging to "breakers" 1, 2, and 3 (Davies uses A, B and C). The sums of the "breakers" are totaled, Figure 4a. Then the tapes are reshuffled into three piles for "gaugers" 4, 5 and 6. (Davies uses D, E and F). These sums are added to the tape. The two grand totals, 423.00, check each other. Going to the computer, the sums of squares for "breakers" and for "gaugers" originate from the group totals on the tape, Figure 4a. The interaction sum of squares originates from the totals on the individual tapes, Figure 4.

For variance analyses with one criterion of classification and several items in each group, all groups may well appear on the same, unsevered tape. If there are different numbers of items in each group, which is a nuisance statistically, but so often the case, in practice, a gadget like Figure 5 helps to count them. It is a tape with numbers running serially from 1 to, say 30. When laid alongside a tape of data, the number of items per group is readily counted. Mrs. Park scotch-taped hers onto a stiff cardboard, so that it would lie flat and wouldn't wear out.

PROCESS DATA

Mrs. Park also reviews much process data, in preparation for setting up control charts. When subgroups of five are involved, the tape works like a charm for getting averages of the subgroups and the grand

(4) "Statistical Methods in Research and Production," O. L. Davies. Table 5.5, page 91

```
1
2
3
4
5
6
7
8
9
.1 0
.1 1
.1 2
.1 3
.1 4
.1 5
.1 6
.1 7
.1 8
.1 9
.2 0
.2 1
.2 2
.2 3
.2 4
.2 5
.2 6
.2 7
.2 8
.2 9
.3 0
```

Figure 5

average. Mr. Small taught us this one. Figure 6 illustrates the method. The problem is Grant's data[5] on measurements of rheostat knobs, five knobs being measured per sample. The five measurements are added on the tape and subtotaled. Then, the amount of the sub-total is added to this and a group total taken. This group total is ten times the average of the subgroup. Move the decimal point one place to the left and you have the average of the subgroup of five. This problem took one yard, 7⅝ inches of tape. (Every time Mrs. Park gets ten yards, she scores herself a touchdown!)

Incidentally, the grand total of all data on this tape is ten times the total of all the X's. Divide the grand total by ten and then by the number of samples, 27. This gives the grand average, $\bar{X}$.

COVARIANCE ANALYSIS

For those who use covariance

(5) "Statistical Quality Control"—Eugene L. Grant. McGraw-Hill. Page 27.

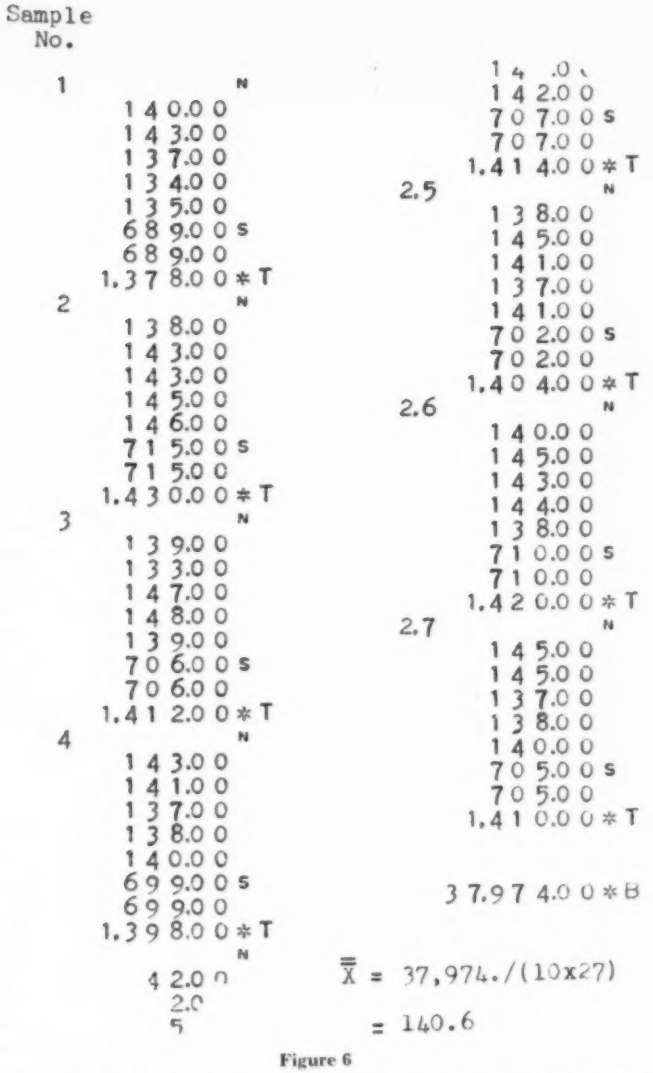

Figure 6

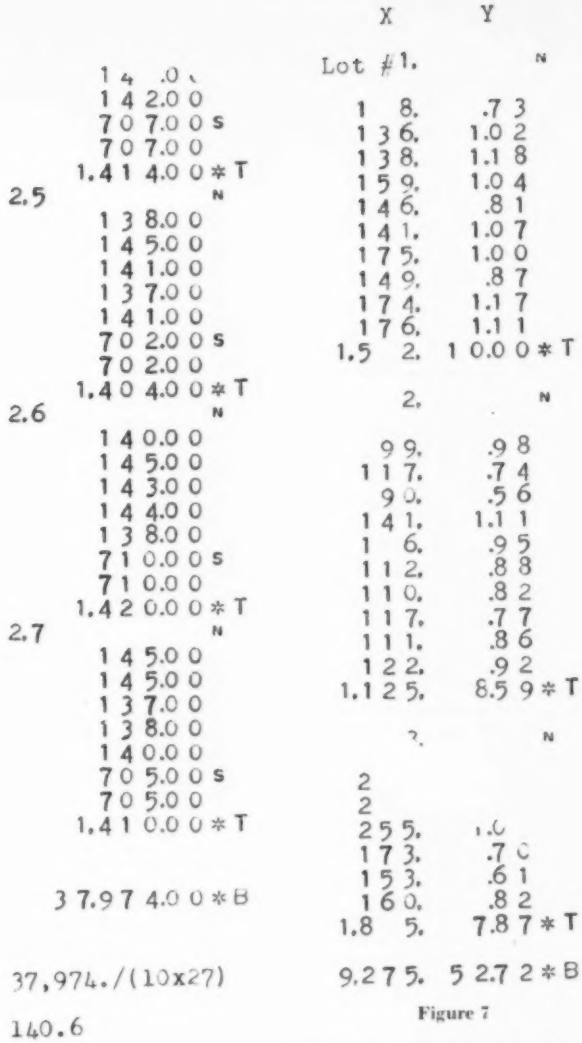

Figure 7

analysis, the tapes are really an asset. Formerly, we filled two, large data sheets almost solidly with data and computations for each covariance problem. With that bulk of data errors were a continual hazard. Now, we set up covariance problems with tapes and Mrs. Park has a steady succession of numerical checks. The printed tapes are also more orderly than our former data sheets, so that the tendency toward error has largely evaporated. These conveniences have greatly eased the mental strain of such mass-production computation, in addition to their saving us time from fewer errors.

Snedecor's covariance problem[6] on the gain in weight of some laboratory rodents is illustrated in Figures 7 through 9. Mrs. Park builds these covariances up tape by tape, scotch-taping them together, horizontally, into panels. Since covariance is, descriptively, a collection of regression techniques on a mass basis, we can handle them in just that manner—mass production.

To start, Mrs. Park usually has to put the original, raw data onto tape, so as to have it convenient to work with. That is, by this time, an old story and the two column split is used to list the X and Y variables side by side. She does group after group of these until all are recorded. (See Figure 7.) From then on, the mass-production really starts. The computer and the adding machine are used conjunctively, the former in front of Mrs. Park, the latter at her right hand. As soon as a com-

(6) "Statistical Methods"—Geo. W. Snedecor —Iowa State College Press. Table 12.1, page 318.

n	SX	SX^2	SY	SY^2	SXY
1.0	1.50 2.00	229.760.00	1.	1 2. 6 2.00	151.846.00
1.0	1.12 5.00	128.24 5.00	85 9.00	75.81 9.00	97.77 6.00
1.0	2. 9 2.00	439.54 4.00	995.00	1 75.00	2 8.89 2.00
1.0	1.56 8.00	248.88 6.00	79 2.00	64.46 2.00	125.37 0.00
1.0	1.18 3.00	141.52 5.00	83 9.00	72.61 3.00	99.19 5.00
1.0	1.80 5.00	337.43 3.00	78 7.00	64.40 1.00	145.87 2.00
6.0.	9.27 5.00 *	1.525.39 3.00 *	5.27 2.00 *	479.43 2.00 *	828.95 1.00 *

Figure 8

putation is completed, the result is entered on the adding machine tape and she goes back to the computer for another. When the results of all the groups are on the tape, it is totaled and the next one started. The finished product is an expanse of tapes, all held in alignment with Scotch tape. Figure 8 is such a panel for the raw data sums, sums of squares and products.

The first and third tapes in the panel, SX and SY, are summaries of the lot totals (Figure 7) for the X and Y variables. (S is Snedecor's abbreviation for denoting "the sum of X", SX, or "the sum of Y", SY.) In the left column of the SX tape, we carried the number of items per lot, n, getting their total simultaneously. The fact that the decimal point doesn't always come out right in these split columns hasn't worried Mrs. Park (or occasioned any errors!). She puts in her own decimal points where they belong! The second and fourth tapes, SX^2 and SY^2 of the panel (Figure 8) obtain their values from the computer as the individuals of each group are squared and summed. A third trip through the computer produces the last tape for SXY.

The three trips through the computer to get these sums of squares and products is not as speedy as with the binomial theorem method whereby all are obtained at one summing. However, with the moderately long to extensive sets of data (that are often Mrs. Park's lot) the three trip method, with its capabilities for crosschecking has made it rarely necessary to repeat a calculation because of error.

Having gotten this panel of raw data all neatly lined up, it is then an easy task to compute the data of Figure 9. Here, again, the computer and the adding machine work hand in hand. After the first three tapes of this panel are completed, a blank tape is scotched in before the last one. This provides space for pencilling in the regression and correlation coefficients. These are calculated in a continuing operation, concluded by calculating the sum of squares of Errors of Estimate. Presumably, if we had two adding machines, the whole business could be printed on tape. But here we really draw the line. It isn't much work to pencil in the coefficients "b" and "r" on the blank tape and we do just that!

D.F.	Sx^2	Sxy	Sy^2	b	r	Errors of Estimate D.F.	S.S.
9	4.15 9.60	1.64 6.00	2. 6 2.00	.3957	.5620	8	1.41 0.66
9	1.68 2.50	1.13 8.50	2. 3 0.90	.6767	.6159*	8	1.26 0.51
9	1.89 7.60	7 3 8.00	1. 7 2.50	.3889	.5173	8	7 8 5.48
9	3. 2 3.60	1.18 4.40	1.73 5.60	.3917	.5170	8	1.27 1.65
9	1.57 6.10	5 8.70 -	2.22 0.90	-.0372	-.0314	8	2.21 8.71
9	11.63 0.50	3.81 8.50	2.46 4.10	.3283	.7133*	8	1.21 0.42
						4.8.	8.15 7.43 *
(5.4)	23.96 9.90 *	8.46 6.70 *	11.58 6.00 *	.3532	.5081**	53.	8.595.37

Figure 9

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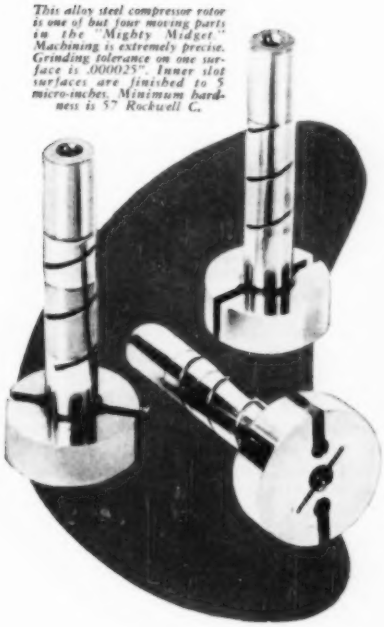

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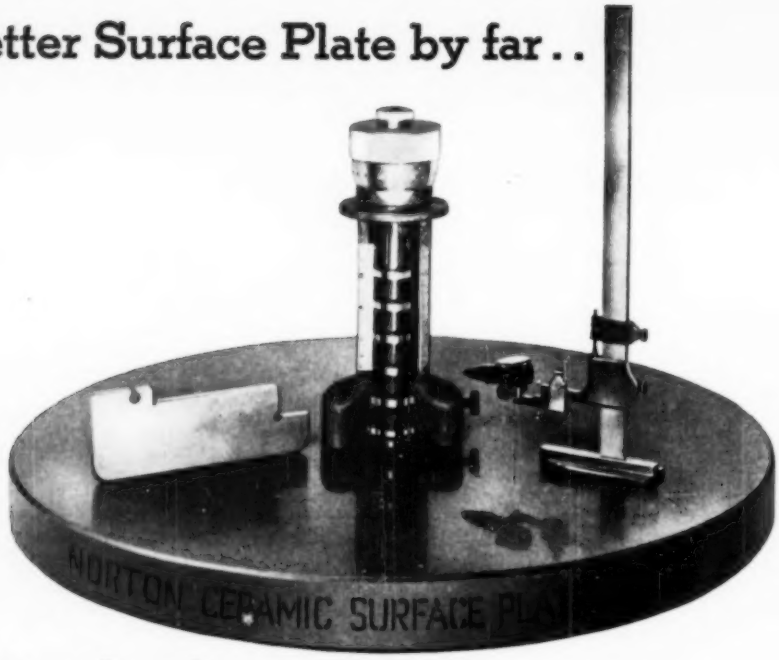

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Acceptance Inspection of Purchased Material*

J. E. PALMER
Western Electric Company, Inc.

E. G. D. PATERSON
Bell Telephone Laboratories, Inc.

IT IS the purpose of this paper to describe some of the principles and procedures employed in the inspection of purchased material in the form of components or finished products. The authors' experience has been largely with procedures used in the Bell System, and the illustrations have therefore been drawn from this source. It is felt, however, that considerations leading to the choice of specific inspection techniques will be generally applicable even though the number and volume of items purchased and the number of suppliers involved may in some cases differ widely. In this presentation, stress has been placed on a discussion of the broader gauge factors underlying the engineering planning of inspection procedures rather than on specific sampling and control techniques.

GENERAL CONSIDERATIONS AFFECTING PURCHASED MATERIAL ACCEPTANCE

The most general form of acceptance inspection of purchased material involves examinations by the purchaser of individual incoming shipments of product. The type and extent of the specific inspection procedures employed depend upon such factors as the nature of the product itself, the quantities involved, the degree of quality control desired and the supplier's past performance with respect to quality. In practice, inspections of incoming product may vary from a superficial visual examination of a very small sample to the application of scientifically prepared plans based upon the latest quality control techniques. The tendency in recent years has been to reduce incoming acceptance inspection on the part of the purchaser by transferring to the supplier the responsibility for providing to the purchaser certified factual quality information of specified character and quantity.

This latter arrangement has been in effect for many years in the Bell System insofar as it applies to products manufactured by the Western Electric Company (the manufacturing unit of the System) for the Operating Telephone Companies. Bell Telephone Laboratories acts as the Quality Assurance agent for the Operating Companies in specifying the type and quantity of inspection results information to be furnished to the Laboratories as necessary for its continuous product quality surveillance. Thus the acceptance inspections covering specialized telephone apparatus and equipment such as cable, central office equipment, telephone instruments and the like—aggregating under the present System expansion program some several hundred million dollars worth of products annually—are all made by the manufacturer under arrangements which properly safeguard the purchasing telephone companies. Since it is possible to combine into one operation the inspections which the manufacturer as a prudent supplier necessarily makes on his own behalf with those required for assurance purposes by the customer, the inspection economies possible under this arrangement are very substantial.

There are many finished products needed for maintenance and for additions to telephone plant, which are of a type commonly used in other industries and which may be purchased from numerous suppliers economically and at satisfactory levels of quality. These are known in the Bell System as telephone supplies and include such items as automotive equipment, motor generators, tools, first aid supplies, storage batteries, crossarms, and clay conduit. Western Electric Company acts as the purchasing agent for the Operating Companies in the procurement of such products. Total Bell System purchases of this class of material aggregated some $170,000,000 during 1950. Originally, it was the practice for each of the Operating Companies to insure by its own inspection that the quality of these products was satisfactory. The many advantages of a centralized inspection agency for this purpose soon became apparent, with the result that for many years Western Electric has acted not only as the purchasing agent for the System but also as the inspection agency in respect to these purchased products.

The purpose of any properly designed acceptance inspection plan is to assure at minimum overall cost a product whose quality is above minimum acceptable standards. Overall cost includes the effect upon the price of the product of the minimum standards established, the immediate and long-time tangible and intangible losses involved in the acceptance of substandard quality, and the direct costs of the application of the plan per se. Tolerances for defects, consumer's risks, and minimum sampling plans should always be determined with the overall cost factor as a background. The problem of establishing the best inspection procedure thus involves the determination of parameters of which some may be calculated with mathematical exactitude, some estimated, and some, in effect, just plain intelligently guessed-at. Who, for example, has ever seen a rigorous formula for the calculation of the effect of good will? Yet good will is important—especially so in a service industry. We must not lose sight of the fact that, excellent as they are, the techniques of sampling inspection and quality control are only tools to be wisely selected and guided by intelligent hands.

The Bell System includes a large number of Operating Companies and Long Lines areas throughout the United States. For each of these operating units Western Electric purchases materials ranging in variety from teletypewriter paper to linemen's rubber blankets, from

*Presented on the technical program of the Fifth National Convention, ASQC, Cleveland, Ohio, May 23, 1951.

Western Electric Poles, December 1950

Western Electric and PP&L Stocks, January 1951

small air valves to pole derricks, from aromatic spirits of ammonia to truck bodies, from cotton splicing sleeves to telephone poles.* Some of the items are available from only one or a few sources of supply. Some must be purchased from many sources in order to provide the quantities needed. Some are simple products commercially available at satisfactory quality levels with relatively few specification requirements. Some are specially designed by the System and covered by detailed specifications involving complicated testing equipment for their verification. Some are bulky and heavy items where transportation represents an important cost component. Under these circumstances there are several decided advantages in having a single agency inspect these products at the source of supply:

1. The special skills required for proper product inspection involve the training of fewer people than would be the case if each operating area were to inspect its own incoming shipments.
2. In the case of new products or new suppliers, relatively little information may be available upon which to formulate proper inspection procedures. In such cases, a preliminary review by the inspector of the supplier's plant facilities, processes, personnel, and quality control methods affords extremely helpful information upon which to base suitable acceptance inspection plans. A central agency with trained inspectors strategically located facilitates these reviews. In some instances, they have disclosed the prospective supplier's inability to produce product at satisfactory levels of quality and, hence, his inability to justify the placing with him of a purchase contract for the product.
3. Uniformity of inspection methods and acceptance criteria, especially in the case of "judgment" items, is more easily maintained—a feature necessary from the users' and fair from the suppliers' standpoints.
4. Shipping costs and, to a large extent, service delays arising from rejection of nonconforming material at destination are eliminated by rejection at source.
5. For any given value of protection (in respect to both producer's and consumer's risks) a smaller sampling ratio is required for the larger size lots inspected at the source as compared with the smaller size lots which would be inspected at destination.
6. Irregularities in product are earlier detected and corrected.
7. Optimum flexibility and efficient use of inspection manpower is facilitated.

A recent study made by Western Electric of raw materials and parts purchased for further manufacturing into completed items is of interest. The study covered a two months period during which 6,847 separate lots were shipped from 514 suppliers into one of Western's plants. Incoming or so-called receiving inspection was made by Western with the following results: 69% or 4,709 of the total lots received were non-conforming, and these were furnished by one third of the suppliers involved. All of the lots furnished by 22 suppliers were non-conforming.

For its centralized inspection of purchased materials at source of supply, Western Electric has as its Supplies Inspection Organization a group of some 170 people comprising over 120 inspectors together with the necessary staff and administrative personnel. The majority of the inspectors are located in areas close to the sources of supply. (Actually there are sixty basic locations throughout the country handling 1,000 suppliers.) Where volume and regularity of product flow warrant, inspectors are resident full time at the suppliers' factories. Each man is trained in his particular inspection field. He is supplied with a group of instructions covering acceptance inspection procedures and acceptance criteria which apply to the products which he is called upon to inspect. As a matter of policy, established because of the many advantages of so doing, these instructions are prepared as separate documents from the design specifications although obviously they must be consonant with the latter. Copies of the instructions are also furnished to the suppliers as part of the supply contracts with Western, so that each supplier is familiar with what is expected in the way of inspection procedures.

All told, there are presently 600 such operating instructions covering standard products regularly required by the System. Like its counterpart in the inspection specifications covering products manufac-

*Western also purchases for the Operating Companies commercial products in the nature of office and janitor supplies, such as inks, soaps, waxes and polishes. Quality control of these materials is by inspection in its central testing laboratory of samples from purchased lots. Inspection procedures relating to such products are not discussed in this paper.

tured by Western, each of these instructions embodies the safeguards required by Western to fulfil its obligation as a Purchasing Agent for the Operating Companies as well as the information necessary for Bell Laboratories to fulfil its function as the Quality Assurance agent for the Operating Companies. Each instruction is tailor-made to fit a particular product, or group of similar products, and the circumstances under which this product is supplied. Underlying their preparation is the specialized knowledge of Bell Laboratories in sampling techniques as well as the information which accumulates from Laboratories' handling of all engineering complaints on products supplied to the Operating Companies. Underlying their preparation also is all of the practical experience which Western has had in its actual inspection operations. Throughout their life, the procedures are reviewed regularly for their completeness and correctness as part of the Quality Survey Program carried on by the System, in which a committee of Laboratories, Western, and Supplier representatives reviews all factors having a bearing on the quality of the product which is being supplied.

Let us examine a few of these individual instructions and the reasons for the particular procedures and criteria incorporated in them.

TELEPHONE POLES

For outside plant line construction purposes, the Bell System uses some 800,000 poles yearly. They vary as to species—Southern pine, Western larch, cedar, etc.—as to diametrical size, as to length, and as to the preservative treatment applied to insure a satisfactory life under the particular environment to which they will be subject. They are purchased from more than fifty suppliers located in timber areas throughout the country.

A telephone pole is essentially a product of nature. To be sure, it comes from a tree which man selects, cuts, trims, shaves, frames, and subjects to preservative processes. But in respect to its shape, its intrinsic strength, and the size, number, and location of its knots, it is a product of nature. As such it has been potentially subject to all of nature's vagaries: drouth, fire, attack by insects, disease, snow loads, wind damage, etc.

One of our best indications of past environmental variations in a locality is obtained from a study of the effects left upon the ring-growth of a tree which grew in the area. To us as quality engineers each of these environmental factors is properly characterized as an assignable cause of variation with all its implications from the standpoint of quality control. Our inspection problem is made no easier by the knowledge that the pole will have reached us as a finished product only after it has gone through several selection processes—each none too well defined as to criteria, and each with its effect on the final shape of the quality distribution of the lot of which the pole is a member. Shipping expenses represent an important element in the cost of the pole. The cost of erecting the pole in place and of adding the equipment which it is to carry is many times the cost of the pole itself. Long useful life is hence economically vital. Potentially weak poles introduce hazards to line construction and maintenance personnel, to expensive line equipment, to continuity of telephone service, and, if the pole is installed in a busy area, to the general public.

All of these factors point to a low tolerance for defectives and to a low consumer's risk. After a pole has been impregnated with preservative, many of the tell-tale evidences of weakening effects such as decay are obscured. We must therefore examine the pole before the preservation process—"in the white," as we say—and, in fact, we find that we must so examine each pole in each lot. While this is technically a 100% inspection, we realize, of course, that actually we see only the surface. Fortunately, by the skilled inspector much can be learned from a surface examination, and he can and will take increment borings or fresh butt or top cuts on those poles whose surfaces cause suspicion. But it is evident that the inspector must be highly trained to recognize those many characteristics which affect the timber quality. And it is evident that it is unlikely that the same individual will be equally well qualified to inspect motor-generator sets. In other words, he must be a specialist in timber product inspection. (The average total inspection time per pole is only three minutes.)

Preservative is introduced into the pole to protect it against insect damage and disease. Any niche in untreated wood left by a climbing iron spur or a surface check is a potential resting place for a spore of wood-destroying fungus. Any exposed untreated wood below groundline offers an avenue for attack by a colony of termites. To be effective, the preservative must contain sufficient amounts of toxic agents, it must be properly dispersed in the pole, and it must neither "bleed" (exude from the pole) nor leach out over a long period of years. Fulfillment of some of these requirements can be checked by inspection of the finished product and by analysis of the preservative.

For example, statistical analyses have been made of data obtained from test borings from thousands of treated poles representing the variations in the preservative process in respect to depth of penetration and percentage of sapwood penetrated. As a result of this study, it has been determined that in the case of the smaller sizes of poles treated (preserved) as a single charge in the treating cylinder, a single test boring from each of twenty representative poles in the charge will suffice as a sample. If eighteen or more borings meet certain penetration limits, the entire charge is acceptable for this feature. If 16 or 17 borings meet requirements, each pole in the charge should be bored and its acceptability determined on the basis of its individual boring. If less than 16 borings meet requirements, the charge is not acceptable without retreatment.

Variation in treating results in the larger size poles, and evaluation of the sampling risks involved, necessitate that a boring be taken from each of the larger poles and that each such pole be accepted or rejected on the basis of the results of its individual boring. In respect to certain features of the preservative dispersion in the pole, and to freedom from the likelihood of bleeding, there are no economically applicable "end requirements" and resort must be had to specifying and checking the preservative process itself*.

*Specification of the design intent in terms of end requirements is always desirable where economically feasible, both from the standpoint of manufacture and inspection. Very recently Bell Laboratories has developed specifications which base acceptability of preservative treatment upon end requirements. Processing requirements are eliminated from these specifications except for prohibitions concerning certain detrimental practices which might otherwise be employed during the treating process. Little commercial experience has been had, however, under this new type of specification.

To provide the inspectors with the information necessary for pole inspection, three general instructions have been prepared:

1. Preliminary Inspection of Poles
2. Treatment and Final Inspection of Timber Products
3. Inspection of Wood Preservatives

Supplementing the foregoing instructions, there are separate instructions to cover such detailed subjects as Decay in Timber, Checking of Gauges at Wood Preserving Plants, Moisture Tests on Wooden Materials, Percent of Sapwood Penetrated, Classification of Defects, etc. All told, some 28 instructions including 46 pages of text, tables, charts, and diagrams have been issued to insure that the techniques applied to the acceptance inspection of telephone poles are such as to provide product at or above the minimum specified level of quality.

HARDWARE

There is a large group of metal details used in outside plant construction which falls in the category known as outside plant hardware. Included are such items as bolts, braces, brackets, clamps, metal castings, guards, rings and rods. Annual purchases of these items aggregate some 20,000 tons. While they differ substantially as to size and shape, they are similar from an inspection standpoint in that they are made of like material and have as their main requirements, strength, "assemblability" and durability. They are normally furnished regularly, and frequently in such quantities as to require a resident inspector at the plant. Many of them can be and are inspected under one general inspection instruction. Their principal specification requirements relate to material strength, freedom from brittleness, nut fit for threaded items, dimensional limits to insure strength and fit, and adequacy of the protective galvanizing coating.

Since these items are made of materials and by processes which should be susceptible to good control, it would appear that some of the straightforward statistical sampling techniques would find ready application. While they would indeed from a purely statistical standpoint,

(Continued from page 17)

The specifying of processing methods for preservative treatment is traditional and still the general practice in the procurement of treated timber products.

SURFACE INSPECTION

Class of Hardware	Sample Size	Report as Conforming	Report as Non-Conforming
CLASS A: Pole balconies Pole seats Iron and Steel castings except cable dogs, grade clamps, strand connectors and saddle supports for cable Welded (except spot welded) articles Iron or Steel Pipe All other Hardware in lots of not over 100 articles	100% of the lot	All articles which conform	All articles which do not conform
CLASS B: Hardware having a thread and nut, for which a definite nut fit is specified, submitted in a lot of over 100 articles	5% of the lot but not less than 100 or more than 1000 articles	Entire lot if: (1)Articles not conforming for nut fit are not over 1%, and: (2)Articles not conforming for patent marking are not over 10%, and: (3)Articles not conforming for other features are not over 3%, and: (4)Defects are not pronounced.	Entire lot if: (1)Articles not conforming for nut fit are over 1%, or: (2)Articles not conforming for patent marking are over 10%, or: (3)Articles not conforming for other features are over 3%, or: (4)Defects are pronounced.
CLASS C: All Hardware not in CLASS A or CLASS B	3% of the lot but not less than 100 or more than 1000 articles	Entire lot if: (1)Articles not conforming for patent marking are not over 10%, and: (2)Articles not conforming for other features are not over 3%, and: (3)Defects are not pronounced.	Entire lot if: (1)Articles not conforming for patent marking are over 10%, or: (2)Articles not conforming for other features are over 3%, or: (2)Defects are pronounced.

Figure 1—**Hardware—Plan for Surface Inspection**

there are other circumstances which lead to the adoption of sampling plans which at first glance appear almost crude in terms of sampling theory. The following excerpt (Figure 1) covering "Surface Inspection" from the general inspection instruction on outside plant hardware shows that not only does the sample size represent a percentage of the lot size (up to a maximum number), but the acceptance criterion is simply a limiting percentage of the sample itself. Obviously from a mathematical point of view the risk of acceptance varies with lot size and the table bears no ear-marks of a calculated minimum inspection plan.

Before we criticize too severely the sampling plans illustrated, let us review some of the circumstances which led to their adoption and their continued use in the face of the availability of so many more statistically conventional plans, of which the Bell System itself has developed quite a few. Note in the first place that items whose use involves personal hazards, such as pole seats and balconies, or items which involve processes such as welding and casting in which flaws may be detected visually, are inspected 100% in any event. Note also that 100% inspection is applied to any lot not in excess of 100 units. This provision protects by 100% inspection many of the larger and more expensive items which are supplied in small lot sizes. Note further that with classes B and

Lot Size	Inspection Sample Sizes			Allowable Number of Defective Rings					
				Projections Over $\frac{1}{4}$"		Finger Feel Roughness Including Projections Over $\frac{1}{4}$"		Other Defects	
	n_1	n_2	$n_1 + n_2$	c_1	c_2	c_1	c_2	c_1	c_2
10,000 or less	200	380	580	3	17	35	104	2	11
10,001 to 20,000	205	470	675	4	18	37	131	2	13
20,001 to 50,000	205	510	715	4	19	37	140	2	14
50,001 to 100,000	205	550	755	4	21	37	147	2	15
Over 100,000	260	540	800	5	23	47	157	3	16

Figure 2—**Cable Rings—Sampling Plan for Surface Inspection**

C hardware, three different percentages of defectives (1, 3 and 10), depending upon the seriousness of the defect involved, are permitted in the sample selected. While, as indicated above, the plans do not thus represent any fixed values of AOQL, they insure consumer protection against substandard lots of a higher order than would be provided by standard 1%, 3%, and 10% AOQL plans.

Most of the items are small and are submitted in large lot sizes in kegs, boxes, or similar containers. The percentage sample which is operative in these circumstances facilitates dispersion of the sample selection over the entire lot. The main attractiveness of the plan from the inspector's standpoint is its simplicity and the ease with which it may be memorized and applied from one inspection lot to the next without recourse to a series of sampling tables. Since it provides the Western Electric inspector with an economical procedure, all things considered, and since it satisfactorily restricts the consumer's risk and provides adequate information to Bell Laboratories, it properly fulfills the dual purpose which is common to all of the inspection procedures.

Special sampling arrangements are in effect, of course, to cover such items as strength, freedom from brittleness, and adequacy of galvanizing. Checks for these features often involve destructive testing. The sample sizes are tailored to recognize the importance of the characteristic in the intended use of the item and the past experience in respect to process averages. It is of interest in this connection to relate that some years ago an extended study was made of galvanizing process results. Specifications commonly require that each galvanized item withstand four one-minute so-called Preece test dips. This is designed to insure a minimum thickness of galvanizing at thin spots and thus the weather resistant properties of the coating. As a result of our studies, requirements were set up on the basis of $\bar{X}$ and range of dips for samples of four from each hardware lot. Subsequent data over a period of years disclosed that the galvanizing process was so well controlled as to permit on all but new items or new suppliers (which must first qualify) what amounts to a periodic verification of the galvanizing process. This consists in the inspection of a few specimens monthly on a straight attributes basis.

Although this single general instruction on the inspection of hardware suffices for some 450 items, there still remains a large number of hardware products which, because of the special nature of their requirements or the circumstances under which they are purchased, require special individual treatment. In such cases a separate inspection instruction is prepared to cover them.

Consider, for example, cable rings which are used to suspend lead covered aerial cable from the supporting steel messenger strand between individual poles. In addition to the usual requirements specified for hardware, it is especially important that the bearing surface of the rings be smooth so as to avoid ring cutting of the lead sheath during the movement which may occur between the rings and the cable. These rings are supplied intermittently in fairly large numbers at a time by two or three manufacturers. The significant feature of the individual instruction prepared for the inspection of these rings is illustrated in Figure 2, which shows the sampling table for surface inspection. Note that it is an adjusted and compressed lot tolerance double sampling table including three acceptance criteria for the one sample selected to represent the lot. The criteria involve a 3% lot tolerance for "other defects," a 4% lot tolerance for projections over ¼", both at a consumer's risk of 10%, and a large lot tolerance (about 20%) for "finger feel roughness" which represents a very severe test for roughness of a magnitude detectable by touch.

Similarly, an individual instruction covers a group of about fifty sizes and types of anchors used in guying, another covers manhole frames and covers, and so on—each designed to fit the special features peculiar to the product covered.

Editorial Note: This paper will be concluded in the November 1951 issue.

Book Reviews

A. C. Cohen, Jr., *Editor*

Correspondence and suggestions concerning book reviews should be sent to:
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Athens, Ga.

TECHNOLOGICAL APPLICATIONS OF STATISTICS

L. H. C. Tippett; John Wiley and Sons, Inc., 1950; 189 + viii pp.; $3.50. Review by H. F. Dodge, Bell Telephone Laboratories, Inc., New York, N. Y.

It is not often that a new book on statistical methods can be equally well recommended to the beginner and to the experienced statistician, but to this reviewer *Technological Applications of Statistics* by L. H. C. Tippett is just such a book. Based on a course of lectures given at the Massachusetts Institute of Technology in 1948, Mr. Tippett has succeeded admirably in his objective—to provide something useful for almost everyone who is interested in statistical methods and their practical application. As a skilled writer and one of England's outstanding statisticians, Mr. Tippett has brought together from his wealth of industrial experience a uniquely practical book highlighted throughout with critical comments on the value and limitations of recognized statistical techniques—a book that should promote a better understanding of the fundamental ideas and thinking that lie behind these methods. For clarity of exposition the book seems outstanding.

The author says that the book is perhaps best regarded as an introduction and companion to a systematic textbook or course of study in applied statistics. His realistic approach has provided a wider and more accessible bridge between the

practical and the theoretical. This is just what many have been looking for—particularly engineers and technicians who are assured by the stories of success in other fields that the methods must be good but have hesitated to apply them because of the seeming foreignness of the language and concepts used. The logic of the methods as applied to technical problems in industry is set forth in a manner that will be particularly helpful to beginners. And for those somewhat more advanced, special consideration has been given "to the basic assumptions and their implications for the technologist and to points that arise in the practical application of the methods." Perhaps that great body of "in-between" workers—neither beginners nor experts—will be loudest in their acclaim because of the practical suggestions that stem from the author's wide experience.

Part I of the book, which comprises about 40% of the contents, deals with the Routine Control of Quality, while Part II treats the subject of Investigation and Experimentation.

Following a concise introductory chapter on frequency distributions and the commonly-used summary measures of quality, the mean $\bar{X}$, the standard deviation, σ, the range, R, and the fraction defective, p, Part I goes on to treat at length the quality control chart as developed by Shewhart, and concludes with a chapter on acceptance sampling.

In the treatment of control charts a clear delineation of four basic uses is given. An illuminating discussion is presented regarding the basic nature of "rational subgroups" into which data are divided in the control chart technique, together with an illustration of what may and what may not properly be considered as "statistical individuals" in a subgroup. Practical hints on how to select samples and how to avoid bias are given by dint of illustrations. Of interest too are his discussion and recommendations regarding the choice among three methods of selecting control-chart hourly samples of 5 from a continuous stream of individual articles; (a) even spaced, one each 12 minutes; (b) at random from each hour's collected production; and (c) 5 produced closely together at the end of each hour's run.

The author discusses two approaches to the computation of control limits for the control chart—approaches that he refers to as the empirical (3-sigma limits) and the statistical (so-called probability limits), the first representing Shewhart's original work, as incorporated in American Standard procedures (A.S.T.M. and Am. Stds. Assn.) on quality control, and the second, representing work done by Dr. Egon Pearson as a modification of the first and incorporated in British Standard procedures. The author's reasons for preferring the latter are given. But considering the American reader, the question arises whether it might not have been helpful, to the student at least, to give a bit of information on Shewhart's basic theory of the operation of statistical control which justifiies the use of 3-sigma control limits, or to have referenced Shewhart's book *Statistical Method from the Viewpoint of Quality Control* (pp. 23-40) which sets forth the fundamental difference between the formal testing of a statistical hypothesis and the empirical testing of the scientific hypotheses (about observable phenomena) employed in the operation of statistical control.

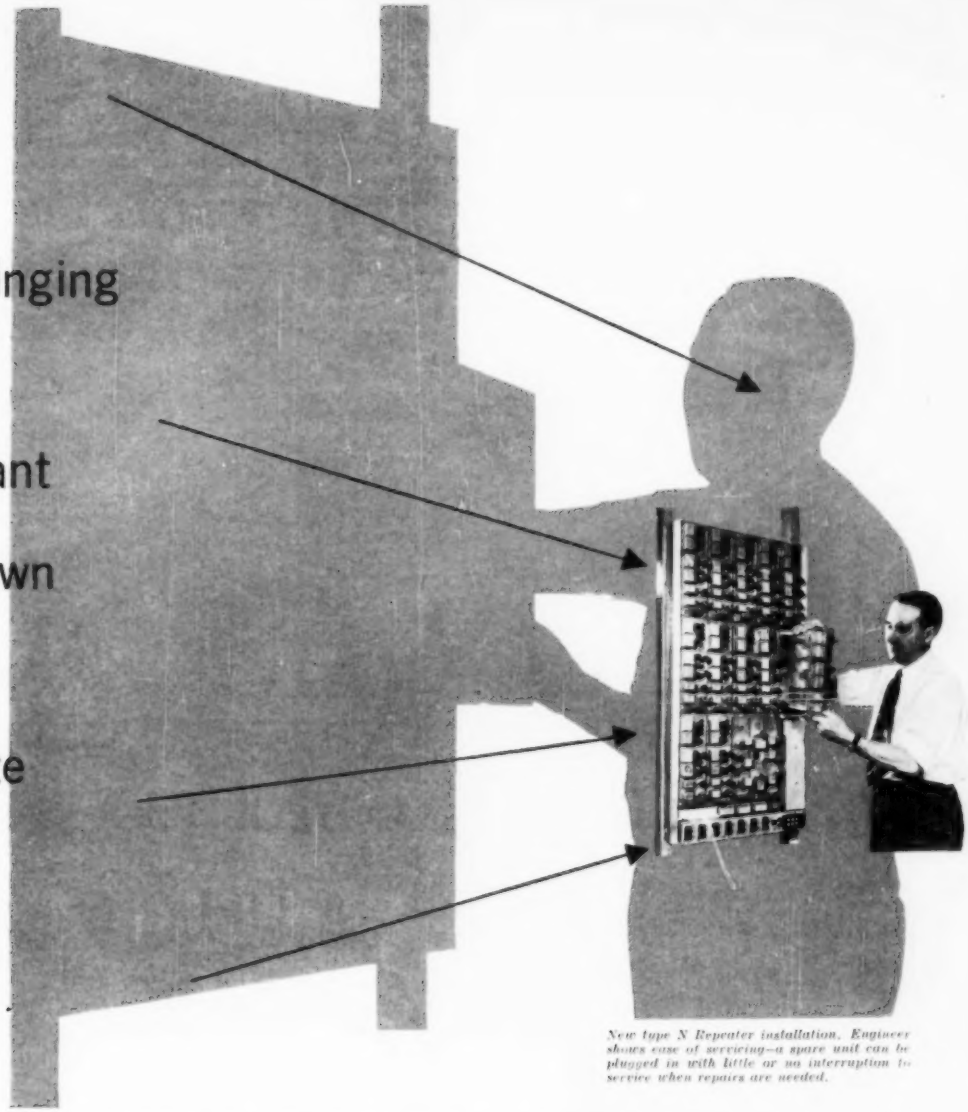
In the chapter on control charts for fraction defective, however, the author points out that it is not feasible, due to discreteness of defectives, to use a fixed value of probability for control limits; he considers the 3-sigma limits as by far the more convenient of the two alternatives that appear in technical Standards here and abroad. For such control charts a handy working rule is proposed: that samples should be large enough to give between 1 and 3 defectives per sample on the average.

In the chapter on Acceptance Sampling, one statement may possibly be subject to misunderstanding by the reader. The author indicates that in order to use the Dodge-Romig sampling tables it is necessary to know the process average percent defective. Actually, the tables may appropriately be used when there is little or no available information regarding the value of the process average—the economy of inspection effort may be affected by a poor estimate or guess but the designated degree of consumer protection remains intact. Maximum economy is approached even with substantial errors in the estimated process average; an approximate value is nearly as good as a precise one; and as the author says in a discussion of economy in a somewhat parallel situation (p. 172): "little is gained by hitting the mark exactly."

Part II with its development of the statistical theory of errors, significance tests, analysis of variance, and planning experiments is a masterful piece of work. Here as in the earlier chapters the story is developed from examples using arithmetical procedures rather than mathematical proofs, for he believes that it is easier for the technician to attain a "feel" for the subject by the arithmetical method. The development of the principles of significance testing proceeds step by step with remarkable clarity. The notion of an infinite population of results, so important to the understanding of the meaning of statistical methods, is neatly explained. Then the t-test, confidence limits, and the errors of a single mean are developed.

Coming down to applications of these methods, the author first gives reasons for choosing particular significance levels, such as .05 and .01, in terms of illustrations that will make much sense to the engineer. Then comes a most illuminating discussion on the nature and practical import of the assumptions of (a) normality, (b) equal variability, (c) randomness, and (d) inclusiveness of the estimate of error. Here, as elsewhere, he emphasizes the important part played by technical knowledge and judgment in the successful application of statistical methods. He points out situations for which the best method of procedure may be in doubt, some for which he himself does not know the answer. All of this makes the engineer feel much better, for if an expert indicates that all is not known, the engineer is reassured that some of his uncertainties may be due not to his own statistical immaturity but rather to things that bother others. For example, the author states that there are ways of dealing with data when the assumption of equal variability is not justified, "but they are not accepted by all statisticians." And again, "just what is the effect of heterogeneity (lack of control) of variability on the t-test of significance I do not know." He places one on guard by saying that, where an inappropriate statistical model is used, a significant value of t may indicate that the assumptions or the hypothesis or both are wrong. The collection

bringing a giant down to size



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of statements of this sort, although perhaps appearing in the literature in scattered locations, will be found especially valuable to the technical worker who wants to know to what extent he must expect to exercise engineering judgment.

The material on the application of analysis of variance first, for basic forms and, second, for composite forms, will be welcomed by many, especially the general discussion with its warnings and suggestions. It emphasizes, for example, something that is too often overlooked—that complex forms are commonly analyzed without much consideration being given to the validity of the most important assumption that certain component variations are homogeneous. And it offers a "good working rule" for the pooling of mean square values—a subject of many lively discussions—suggesting that the main basis for the decision be technical rather than statistical.

The discussion of the assumptions underlying correlation analysis and of the interpretation of results is likewise quite informative. It states that correlation analysis has not proved to be a very powerful tool for disentangling causes and effects in a complex situation, that this method is chiefly useful for giving quantitative descriptions when the causal pattern underlying the experimental data is fairly well understood.

The final chapter on planning an investigation will itself be worth the price of the book to many. Many statistical workers will be pleased to have at hand the following statement, for use as a quotation on appropriate occasions: "Until comparatively recently it was common for an experimenter to complete his work without considering the requirements of statistical analysis and for him to turn to statistics only when the results were in such a mess that he could make little of them. Then he would often find that the statistician also could make little of them." The discussion of economy of arrangement and number of observations will be widely read with interest. Here the engineer will be glad to have the author's comment that the most economical arrangement is not usually much better than those that are near it. Many will gain much from the clear and practical discussion of the random arrangement, the randomized block arrangement, the Latin-square arrangement and certain basic thoughts on how to determine the number of observations. In arriving at a compromise between simple and complex experiments the author "places the full comprehension of the experimental results by the technicians very high in the list of *desiderata*."

All in all, the book will be found most realistic and stimulating to quality control engineers and to others engaged in applications of statistical methods. It helps to be told, by one who knows, that the simpler methods should be applied first and that the complex ones should be taken up only as experience and comprehension grow. The book is destined to be an important influence for wider understanding and use of statistical methods in industry.

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PAUL C. CLIFFORD, Editor

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Montclair, N. J.

AND WHEN HE GOT THERE, THE CUPBOARD WAS BARE

Mother Hubbard has nothing on the new Editor of the Problems Department. Here I am, all ready to serve up the answers, only there aren't any problems. I find this rather surprising, because my experience in Quality Control has indicated that where two or three are gathered together, they're all asking each other questions. They even ask me a lot of them. Now I'm in a post where I don't have to answer them, even if I could. I can point with pride to my title: Editor of the Problems Department, ASQC—and then I can get someone else to answer the question—in print. (At least I can if my fair-weather friends don't take cover every time I look around for help.)

THEY WENT THATAWAY

This seems as good a time as any to state the objectives of this particular department as I see them.

First: The department should attempt to state problems that are of interest to the quality control engineer. It is hoped that the members of ASQC will submit a variety of such problems to the editor.

Second: These problems will be on different aspects of quality control. Some will be straight forward problems in statistical method. Others will concern the functional operation of a quality control program. Still others would concern the economic aspects of quality control.

Third: I am an editor, not the Answer Man. I'll try to get some qualified person in the field to discuss any problem submitted. This may be quite different from giving a solution based either on theory or on experience.

Fourth: In addition to rather standard problems that can be discussed briefly, there are others that will call for considerable research. We might list such problems as "projects." I hope that where a quality control man finds that he is handicapped by lack of adequate techniques he will propose such problems to the editor. In addition to listing such projects, the editor will attempt to maintain a file of projects now under way, either by individuals or by industries or by schools. In this area of projects, the Problem Department could serve as liaison between those in the field who use the tools once they are fashioned, and those who develop the techniques.

JUST TRY THESE ON FOR SIZE

Since there are no problems on hand, the editor feels it incumbent on him to submit some himself. By way of illustration I'm choosing one of each type I mentioned: one problem, one project. Readers are invited to submit their evaluation, either as a solution, or as an indication of the value of the problem.

Problem 1

Many companies have used the demerit rating plan for measuring the quality of final products. One system of weights for different classes of defects is:

Class A—Critical Defects	100 demerits
Class B—Serious Defects	50 demerits
Class C—Moderately Serious Defects	10 demerits
Class D—Minor Defects	1 demerit

If we let d_i represent the total number of demerits for the i-th unit, $\bar{d}$ the average of the d_i, then control limits are usually computed as $\bar{d} \pm 3\sqrt{\bar{d}}$. The justification usually given for this procedure is that each type of defect is assumed to be a Poisson distribution, and it has been proved that the sum of independent Poisson distributions is a Poisson distribution. Here, however, we have not just sums, but weighted sums.

Suppose that each of the weights for a class of defects is multiplied by some number a. The average would be multiplied by this same number a. Then the control limits would be $a\bar{d} \pm 3\sqrt{a\bar{d}}$. By properly choosing a, the control limits can be made arbitrarily wide or narrow. Thus, if originally $\bar{d} = 40$, the control limits are 21 and 59. By choosing $a = 0.1$ we get a new average of 4, but the control limits are now 0 and 10. (At this point it might be mentioned that the problem was originally highlighted by just such a mistake in arithmetic.)

Having illustrated the problem, we invite discussion of two questions.

1. What is the distribution of the sum of weighted Poisson distributions? Is there any approximate solution that covers the usual range of weights?
2. If the occurrence of a certain type of defect assures that there will be a point out of control (a Class A defect in the above example will put the point above the upper control limit) should the chart be maintained only on the less serious defects?

Project 1

Almost any text on quality control points out the advantages of variable measurements over attributes in indicating slippage of the mean or change in variability. Operationally, however, gauges have many advantages. They do not require the operator skill, do not need as careful maintenance, and may be more economical. Is it possible to design gauges so that they give almost as much information as measuring instruments? It may be that control gauges set at $x \pm t\sigma$ may be the most economic method of detecting lack of control, once the population is known. This same idea is in back of increased tests of severity.

Depending on the relative importance of slippage of the mean and increase in variability, what is the most efficient value of t to use? How will this value of t change for different types of populations? What size sample needs to be gauged to have the same efficiency as a standard average-range control chart for subgroups of five?

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Practical Aids

ELLIS R. OTT, Editor

Computation of Control Limits for p-Charts when the Samples Vary in Size

HOWARD L. JONES

Illinois Bell Telephone Company

Send your "Practical Aid" contribution to:

Dr. Ellis R. Ott
Rutgers University
77 Hamilton Street
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In establishing and maintaining p-charts for samples that vary in size, one of the difficulties is the labor of computing the control limts. When $\bar{p}$ is sufficiently small, however, so that the equation

$$\sigma_p = \sqrt{\bar{p}/n}$$

is essentially correct, considerable simplification is possible. (Compare Paul Peach, *An Introduction to Industrial Statistics and Quality Control*, 1947, page 63.)

Limits can be obtained easily from Table 1, which is independent of $\bar{p}$. Suppose that $\bar{p}$ has been computed from sample data by dividing the observed total number of defective units by the total number of units inspected. We first find the reciprocal, $1/\bar{p}$, and multiply this value by each of the values shown in the columns headed U and L in Table 1. (The derivation is given in the Note below.)

For example, if it has been established that $\bar{p} = .00006$, we enter the products in a table like Table 2. In other words,

$$n_U = U(1/\bar{p})$$

and

$$n_L = L(1/\bar{p}).$$

For any sample containing no more than 10 defective units, one can readily determine from Table 2 whether or not the percent defective is between the control limits.

TABLE 1—**Values of U and L corresponding to various values of c**

c	U	L
0	.00000	9.00000
1	.09167	10.90833
2	.31534	12.68466
3	.62614	14.37386
4	1.00000	16.00000
5	1.42225	17.57775
6	1.88316	19.11684
7	2.37586	20.62414
8	2.89531	22.10469
9	3.43769	23.56231
10	4.00000	25.00000
11	4.57984	26.42016
12	5.17525	27.82475
13	5.78463	29.21537
14	6.40661	30.59339
15	7.04006	31.95994

(a) If the number of units in the sample is less than the number shown in column n_U corresponding to the number of defective units in column c, the percent defective is above the upper control limit.

(b) If the number of units in the sample is greater than the number shown in column n_L, the percent defective is below the lower control limit.

(c) If the number of units in the sample is between n_U and n_L, the percent defective is between the control limits.

Example 1

Suppose we find 2 defective units in a sample of size 10,000. Referring to the line in Table 2 coresponding to c = 2, we see that 10,000 is between 5,256 and 211,411 corresponding to the upper and lower control limits, respectively. Hence, we have no evidence that the percent defective has shifted from its assumed value of .00006.

TABLE 2—**Values of n_U and n_L corresponding to various values of c when $\bar{p} = .00006$**

c	$n_U = U/\bar{p}$	$n_L = L/\bar{p}$
0	0	150,000
1	1,528	181,806
2	5,256	211,411
3	10,436	239,564
4	16,667	266,667
5	23,704	292,963
6	31,386	318,614
7	39,598	343,736
8	48,255	368,412
9	57,295	392,705
10	66,667	416,667

Example 2

Suppose we find 3 defective units in a sample of 5,000. Referring to the line in Table 2 corresponding to c = 3, we see that 5,000 is less than 10,436, which corresponds to the upper control limit. Hence, the observed percent defective is above the upper control limit, and indicates the presence of an assignable cause.

Tables like Table 2 are particularly useful in establishing control limits for a new process that is not in control, so that one or more samples are successively eliminated before the final value of $\bar{p}$, or $\bar{p}'$, is

determined. In setting up such tables, of course, there is no need to carry the tabulated values beyond the maximum size of any sample that is likely to be taken. For example, if the maximum sample size is 25,000, Table 2 need be carried out only as far as $c = 5$ for $\bar{p} = .00006$, and the column headed n_L can be eliminated entirely.

When a standard p' has been determined, it will usually be desirable in problems of process control to plot the percent defective and the control limits on a p-chart because of the psychological advantages, even though Table 2 would enable one to decide at once whether or not the fraction defective is within the control limits. Table 2 may still be useful, however, in making borderline decisions.

NOTE

Underlying Formulas

If the upper and lower control limits are defined by

$$UCL = \bar{p} + 3\sqrt{\bar{p}\,n},$$

and

$$LCL = \bar{p} - 3\sqrt{\bar{p}\,n},$$

the values of p that lie exactly at the control limits are those satisfying the equation

$$p - c_p n = \bar{p} \pm 3\sqrt{p\,n}.$$

Solving for n in terms of c and $\bar{p}$ yields

$$n = \tfrac{1}{2}\,(9 + 2c \pm 3\sqrt{9 + 4c})\,/\bar{p},$$

the + sign corresponding to LCL, and the − sign to UCL. Values of the expression

$$\tfrac{1}{2}\,(9 + 2c \pm 3\sqrt{9 + 4c})$$

are given in Table 1 for different values of c.

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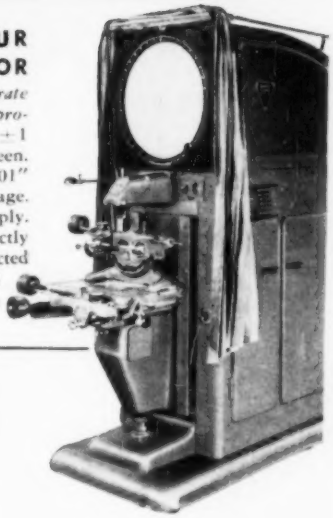

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J. M. JURAN, Editor

Correspondence is invited on potential contributions or problems appropriate for discussion in this department. Address your suggestions to:

J. M. JURAN
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ON SELLING QUALITY CONTROL TO MANAGEMENT

The advocate of quality control is not in business very long before he discovers he must "sell" his product—to the operators, foremen, setup men, engineers and other industrial neighbors. This discovery sometimes comes as a shock, since men of good sense appear to be resisting a very logical and useful device. But the real shock comes when it is discovered that management also needs to be "sold." This sale is so essential that some analysis is in order.

In the first place, there are quite a few things on which management does *not* need to be sold. Management has for a long time wanted low costs, high quality, good customer acceptance, etc. Anyone who lectures management on the desirability of such obvious benefits may be heard out, but only as a courtesy and not for the novelty of his views. But there are several things on which management *does* need selling.

One vital point that some managements have not grasped is that high "quality" and low cost can go hand in hand. The reason lies in the dual use of the word "quality." Some managers have not thought out the distinction between quality of design (grade) and quality of conformance to that design. Higher grade usually means higher cost, but higher quality of conformance usually means lower cost. It is very helpful to point out this distinction to managers.

A second vital point of sale is to meet the argument that the regular supervisory force already has the duty of doing a high quality job at low cost, so why add a further department to perform this same function. The answer lies in the fact that the regular supervision has not the time, the mobility, or (often) the skill to collect and analyze the new data necessary to discover why chronic defects exist. The very presence of chronic causes of loss is evidence of lack of vital facts. To put the quality control engineer in the light of a "fact finder" is a constructive method of presentation.

A third vital point of sale is "Where is the money coming from to pay the quality control engineers?" The answer can usually be "Through reduction of the present losses arising from scrap, rework, customer complaints, etc." Before giving this answer, it is essential that the total of these losses (the "gold in the mine") be known. It has been my invariable experience that computation of this figure has greatly sharpened managerial attention. To talk vaguely of potential benefits of quality control is decidedly less convincing.

These three points of sale—that better quality costs less, that the line supervisors need supplementary fact finders, and that the quality control engineers can be paid entirely out of existing quality losses — have proven to be successful. Not only is there a telling effect on management; the preparing of the supporting information is a valuable step in organizing the thinking and the planning of the quality control department itself.

The foregoing need not exclude showmanship in the form of gadgets, blackboard demonstrations and the like. Often these are a welcome bit of spice to liven up a dreary meeting. But beware of selling something solely on showmanship, for it doesn't stay sold that way.

Actually, managers have little time to hear out the details of how the quality control engineer is going to do his job. (This attitude is taken also with respect to the electronic microscope engineer, the metallurgist and other technical men.) The prime basis of sale must be on the economic results. Any added effect through display of the technical methods is secondary, not primary.

All of the foregoing puts on the quality control engineer the burden of understanding the economic implication of quality control as a prerequisite to selling management. And a very proper burden it is.

Bibliography

JOSEPH MOVSHIN, Editor

Assisted by the Editorial Committee, St. Louis Section, ASQC

On matters concerning the Bibliography Department, send correspondence, suggestions, and contributions to: Mr. Joseph Movshin, 9220 Old Bonhomme Road, St. Louis 24, Mo.

APPLICATION—AUTOMOTIVE INDUSTRY

TWO NEW INSPECTION DEVICES

(Automotive Industries, v. 104, n. 5, March 1, 1951, p. 44)

Two new automotive inspection devices have been added to Ford's quality control program.

The first automatically measures and stamps the size classification number for each of the eight piston bores of an engine. Count is also kept of the number of each classification — to mate the pistons to the bores.

The other gage graphically records the size and nature of the contour of hypoid gears.

APPLICATION—FOOD INDUSTRY

QUALITY CONTROL CLINIC, W. A. Gould, Horticulture Dept., Ohio State University.

(Food Packer, v. 32, n. 4, April 1951, p. 26)

This article, entitled "New Snap Beans Analyzed" is the first of a series of articles on food

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processing by Dr. Gould in subsequent issues of Food Packer. This quality control in the food industry is essentially processing control rather than the application of statistical methods.

APPLICATION—METALLURGICAL INDUSTRY

TRENDS IN STEEL PLANT CONTROLS FOR QUALITY. H. J. Forsyth, Assistant Director of Steel Conservation, Republic Steel Corporation.

(Blast Furnace & Steel Plant, v. 39, n. 1, January 1951, p. 69)

Discusses the past year's activity in steel plant process quality control work, touching on the blast furnace, the open hearth, the blooming and finishing mills, the use of the spectroscope, conservation of manganese, oxidation loss, etc. Limited mention only is made of statistical methods.

APPLICATION—METAL WORKING

WELDING QUALITY CONTROL IN A PETROLEUM REFINERY. A. F. Blumer, Esso Standard Oil Co., Baton Rouge, La.

(The Welding Journal, v. 30, n. 3, March 1951, p. 235)

The problems of the control of welding quality are discussed. The principal points of welding quality control noted are:

1. Welder qualification tests for selection of personnel.
2. Inspection, sampling, and testing of finished welds.
3. Methods and procedures.
4. Testing and evaluation of electrodes.
5. Welding research.

Not particularly statistical quality control.

JUST WHAT TOLERANCES CAN THAT MACHINE MEET? Frank M. Gryna, Jr., Department of Industrial Engineering, New York University.

(Mill & Factory, v. 48, n. 5, May 1951, p. 113)

The determination of "machine capability" must be referred to a basic "condition" of the machine. The conditions are those "which will repeat in the future." Examples of finding machine capability are given. A method published by Prof. S. S. Wilks in "The Annals of Mathematical Statistics", v. 13, n. 4, p. 400 is used.

PRESS TOOL MAINTENANCE AND QUALITY CONTROL. Fred E. Fisher, Senior Analyst, Dearborn Stamping Plant, Ford Motor Company.

(Tooling & Production, v. XVII, n. 3, June 1951, p. 56)

A description of quality control practice in a large stamping plant. Control begins with the raw material as received and extends throughout the processing. Particularly close cooperation between production and quality control is required to solve some unusual problems. In fact, the need and value of this close cooperation and coordination is stressed in general.

APPLICATION—MISCELLANEOUS

TAKING NO CHANCES WITH QUALITY, Fowler McCormick, Chairman of the Board, International Harvester Co.

(Harvester World, v. 42, n. 4, April 1951, p. 12)

In 1936, on a vacation in England, Mr. McCormick heard R. A. Fisher speak. From this event grew one of the earliest applications of statistical quality control at the International Harvester Co. The present day use and value of statistical quality control at International Harvester are then discussed.

MANAGEMENT & PERSONNEL

SAFEGUARDING QUALITY STANDARDS, Eugene C. Yehle, Assistant Professor of Statistics, University of Michigan.

(Michigan Business Review, v. III, n. 3, May 1951, p. 1)

A very interesting article discussing the business basis and philosophy of inspection and quality control in modern industry. Inspection personnel requirement is discussed. Industrial thinking with respect to inspection equipment along with inspection standards and tolerances is briefly touched upon. The place and function of in-process and final inspection are discussed.

SAMPLING PLANS & RELATED TOPICS

SETTING STANDARDS FOR QUALITY CONTROL, C. W. Kennedy, Federal Products Corp.

(Modern Machine Shop, v. 23, n. 12, May 1951, p. 158)

This article points out the need for good judgment of conformance when sampling inspection is used. The author gives some methods for improving this judgment for visual standards such as surface finish and color.

THEORY & APPLICATION—GENERAL

YOUR BUSINESS CAN BE BETTER, Robert Kirk Mueller, Manager, Plastics Division, Monsanto Chemical Co.

(Monsanto Magazine, v. XXX, n. 3, June 1951, p. 23)

Mr. Mueller discusses some fifteen items under the broad category of what statistical con-

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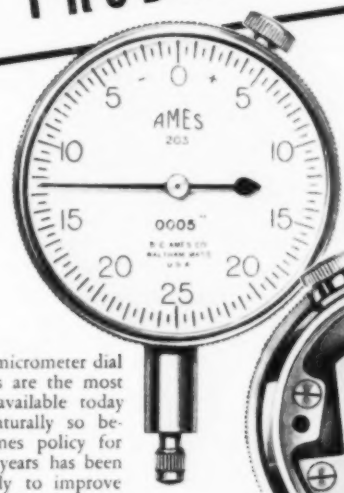

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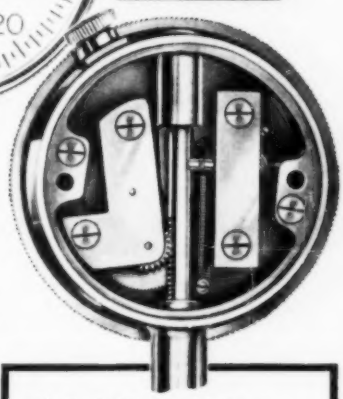

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trol can and actually does accomplish. Some of this is in the application of statistical quality control techniques to business problems other than to the control of quality. For example, sales and forecasting, equipment capacity, and maintenance control are mentioned.

WHAT IS STATISTICAL QUALITY CONTROL? Ralph A. Hefner, Dean, Division of General Studies, Georgia Tech.
(The Journal of Industrial Engineering, May 1951, p. 14)

This article presents a simple non-technical but fairly detailed description of statistical quality control. Something of the fundamental thinking behind the control chart is given along with the discussion of the control chart itself.

TRAINING & EDUCATIONAL

SIGNIFICANCE OF COURSES IN STATISTICS FOR ENGINEERING STUDENTS. Mason E. Wescott, Assistant Professor of Mathematics, Northwestern University.
(Engineering Education, v. 41, n. 9, May 1951, p. 544)

Mr. Wescott presents the case for the teaching of statistics to engineering students. Three main points are discussed. These are:

1. The importance and need of the statistical concept of variation to the engineer.

2. The statistical concept of data as an aid to the engineer in obtaining and evaluating data.

3. The growing industrial interest in statistics that will create better job opportunities for those engineers trained in statistics.

Mr. Wescott also briefly discusses the question of where engineering statistics courses may be given.

COURSES IN STATISTICS FOR ENGINEERING STUDENTS (What and How Statistics Should be Taught to Engineering Students) Irving W. Burr, Professor of Mathematics, Purdue University.
(Engineering Education, v. 41, n. 9, May 1951, p. 548)

Some of the problems involved in the teaching of statistics to engineering students are noted. Methods of presentation, number of courses, general approach and the instructor are discussed. An interesting, rather complete outline of topics of the fundamental statistical material that might be of interest to an engineer is given.

UNDERGRADUATE STATISTICAL EDUCATION, S. S. Wilks, Princeton University.
(Journal of the American Statistical Association, v. 46, n. 253, March 1951, p. 1)

Prof. Wilks discusses in some detail the development of the need for more students trained in statistics and the problems involved in such training. The basic problem is the further extension of statistics into our educational system in place of the former approach to statistics as an advanced limited academic subject.

STATISTICS

QUALITY CONTROL CHART BASED ON GOODNESS-OF-FIT TEST, A. J. Feuell & S. M. Rybicka.
(Nature, v. 167, n. 4240, Feb. 3, 1951, p. 194)

An application of the chi-square test to successive distributions for conformance to an expected distribution.

DISTRIBUTIONS RELATED TO COMPARISON OF TWO MEANS AND TWO REGRESSION COEFFICIENTS, Uttam Chand, University of North Carolina.
(The Annals of Mathematical Statistics, v. 21, n. 4, Dec. 1950, p. 507)

A SHORT-CUT MEASURE OF CORRELATION, William A. Spurr, Stanford University.
(Journal of the American Statistical Association, v. 46, n. 254, March 1951, p. 89)

SIMPLIFIED CALCULATION OF A LINEAR REGRESSION, H. Fairfield Smith.
(Nature, v. 167, n. 4244, March 3, 1951, p. 367)

COMPARISON OF PERCENTAGES IN MATCHED SAMPLES, W. G. Cochran.
(Biometrika, v. 37, Dec. 1950, p. 256)

APPROXIMATION TO THE POINT BINOMIAL, Burton H. Camp, Wesleyan University.
(The Annals of Mathematical Statistics, v. 22, n. 1, March 1951, p. 130)

ANNUAL REPORTS

In accordance with the provisions of the Constitution, the Annual Meeting of the American Society for Quality Control, Inc., was held in Cleveland, Ohio, on May 23 and 25, 1951. The President, Executive Secretary, and Treasurer presented annual reports to the membership on behalf of the Board of Directors. These reports were duly accepted. The reports have been extended to include the balance of the fiscal year ending June 30, 1951, and are published below, while a more detailed report of the Annual Meeting appears under ASQC News section of this issue.

REPORT OF THE BOARD OF DIRECTORS

The Board of Directors of the American Society for Quality Control, Inc., presents herewith its Fifth Annual Report, covering the fiscal year from July 1, 1950 to June 30, 1951. This is intended only as a brief summary of some of the major Society activities, more detailed information having been published in Industrial Quality Control throughout the past year.

The reports of the Executive Secretary and the Treasurer are appended hereto; certificate of audit accompanies the latter.

Executive Committee Meetings

Four meetings were held during the year, as follows:

New York—August 12-13, 1950
New York—October 28-29, 1950
Philadelphia—February 16-17, 1951
Cleveland—May 22-24, 1951

These meetings were devoted to problems involved in the operation of the Society and its many activities. Items of major interest have been reported in the succeeding issues of Industrial Quality Control. In addition, the Officers held many meetings among themselves during the year, both to implement decisions of the Executive Committee, and to lay plans for the future.

Membership

The number of Sections increased from 42 to 48 during the past year with the addition of the following

Montreal (Canada)	Seattle (Washington)
Birmingham (Alabama)	Racine (Wisconsin)
Parkersburg (W. Virginia)	University of Western Ontario (Canada)

The report of the Executive Secretary shows a total membership of 4,224 at the end of the year—a growth of 20% from the 3,510 members a year ago. There is marked evidence of membership stabilization in our Society; 80.4% of last year's members maintained their membership this year, which is an exceptionally high figure.

Meetings

In addition to the usual schedule of Section Meetings, covered in the bi-monthly issues of the News Supplement, there were numerous meetings of special or specific nature held in various parts of the country of which the New England Conference, Toledo Fair, Michigan Forum, conferences at Rutgers, Princeton and Columbia, Middle Atlantic Conference, and Rochester Clinic are typical examples. These special events strongly supplemented the local programs, brought extremely valuable services of many kinds to our members and friends, and provided excellent foundations for the final event—the Fifth National Convention. A program of unusually broad scope was presented by fifty-two speakers in Cleveland on May 23 and 24, 1951, the highlights of the affair having been reported in the July issue of Industrial Quality Control. An attendance of 2,500 persons made this the outstanding event of its kind in Quality Control history, and the financial results will serve to establish a Society Convention Fund to underwrite future conventions.

Year-Book

A Society Year-Book was published in April, 1951, listing all members on record as of February 1, 1951. Complete listings were also provided of all Society Committees, Fellow Members, and other important groups and facts. Preparation and printing of the Year-Book, which was distributed to all members on record at mailing time, was handled by the Republic Steel Corporation.

Publications

The editorial policies, under the able direction of Mason E. Wescott, and the aggressive advertising work sponsored by Raymond S. Saddoris, coupled with the contributions of many individuals, brought a further increase in size to Industrial Quality Control. The average pages per issue of the first five issues of Vol. VII was 43.2 compared to 33.6 for Volume VI. A further increase of eight pages per issue is planned for Volume VIII. The income from the Convention Issue, May, 1950, made possible the expansion of Volume VII; the advertising build-up during the past year from 4.2 pages to 8.8 pages average (exclusive of the Special Convention Issue) per issue, makes that increase self-supporting. A similar income from the 1951 Convention Issue makes possible additional expansion for next year. This steady growth combined with the increased circulation now approaching the 5,000 mark provides a medium of intensified interest to advertisers, as well as greatly increased usefulness to our members and other readers.

The News Supplement, under the splendid editorship of Ernest H. Robinson, has regularly appeared in months alternate to the magazine publication. It has provided "local news" items of interest, a schedule of Section Meetings, and other items of value. It will be continued next year in substantially the same form.

Awards

The following awards were presented at the Annual Banquet of the Society in Cleveland on May 23, 1951:

The 1950 Shewhart Medal to Martin A. Brumbaugh of Syracuse, New York, in recognition of his outstanding contributions in the field of modern quality control. The citation, presented by Alfred L. Davis, and the Medalist Address were published in the July 1951 issue.

The Brumbaugh Award to Irving W. Burr, Purdue University, for the excellence of his paper "A New Method for Approving a Machine or a Process Setting" which appeared in the January, September, and November, 1949 issues of Industrial Quality Control.

Honorary Membership pins were presented to the two Honorary Members of the Society, Walter A. Shewhart and George D. Edwards. The motif of these pins is the Society emblem in miniature, with diamond. Due to enforced absence as the result of a serious automobile accident, Walter Shewhart's pin was presented in absentia and will be tendered to him later.

EXHIBIT A—American Society for Quality Control, Inc.—Membership Report as of June 30, 1951

Region and Section	Membership June 30, 1950	Membership, June 30, 1951			
		Fellows	Senior Members	Members	Total
New England Region					
Boston	135	4	48	77	129
Hartford	54	1	31	107	139
New Hampshire	23	1	2	18	21
So. Connecticut	50	1	27	31	59
Western Massachusetts	51	3	27	32	62
Rhode Island		1	7	31	39
TOTAL	318	11	142	296	449
Middle Atlantic Region					
Baltimore	47	1	8	35	44
Delaware	34	4	10	24	38
Metropolitan	227	23	144	181	348
Philadelphia	196	5	86	146	237
Washington	43	1	9	34	44
TOTAL	547	34	257	420	711
Northern Region					
Buffalo	70	1	17	39	57
Mid-Hudson	42	1	12	20	33
Rochester	85	3	65	5	73
Southern Tier	53	1	16	47	64
Syracuse	105	4	25	79	108
Toronto	34	1	5	58	64
Montreal		1	4	25	30
TOTAL	389	12	144	273	429
Central Region					
Birmingham			1	44	45
Parkersburg				42	42
Muskegon	11		11	20	31
Cincinnati	30	1	13	43	57
Columbus	13	1	11	28	40
Dayton	86	1	23	73	97
Erie	24	1	4	36	41
Georgia	37	2	18	15	35
Ohio	213	6	75	183	264
Pittsburgh	77	2	26	40	68
Tennessee	61	1	21	41	63
Toledo	76	1	3	62	66
Michigan	161	3	57	163	223
TOTAL	789	19	263	790	1072
Mid-West Region					
Evansville			3	11	14
Chicago	220	11	118	104	233
Denver	28	1	5	25	31
Illinois	22	2	17	8	27
Indianapolis	275	4	79	263	346
Iowa	102	7	89	28	124
Milwaukee	129	1	79	67	147
Minnesota	30	2	19	17	38
Muncie	29		11	25	36
N. E. Indiana	70	2	19	25	46
Rock River Valley	52	1	17	32	50
St. Louis	118	4	41	70	115
South Texas	40	1	1	40	42
TOTAL	1115	36	498	715	1249

Region and Section	Membership June 30, 1950	Membership, June 30, 1951 Fellows	Senior Members	Members	Total
Western Region					
Los Angeles	53	2	25	29	56
San Francisco		1	8	36	45
TOTAL	53	3	33	65	101
Members-at-Large	256	5	61	123	189
Members-in-Training	43				24
GRAND TOTALS	3510	120	1398	2682	4224

Board of Directors Meeting

There was but one meeting of the Board during the year, held in Cleveland on May 25, 1951. In addition, one mail ballot was conducted. Present at the meeting were all of the officers, 27 Directors, and 8 guests. 33 Sections were represented.

The Executive Secretary and Treasurer presented their annual reports, and the President reported the highlights of the reports from the Chairmen of the various Society Committees—25 in number.

The Board approved the affiliation of the Society with the American Association for the Advancement of Science, if the invitation of that group for our affiliation should be acted upon favorably by them.

The resolution of the Executive Committee with reference to instructions to the Nominating and Constitution & By-Laws Committees, in view of the proposed changes to permit more than one Vice-President (see report of Executive Committee Meeting of May 22 and 24 under ASQC News for details), was discussed in some detail and finally approved.

The report of the Chairman of the Editorial Board was presented and approved.

The President presented a financial review of Society income and expense for the preceding two years, and the estimated figures for the current fiscal year. Based upon these figures he also presented an estimated budget summary for the 1951-1952 fiscal year with full supporting details. No action was taken on this by the Board. It will be reviewed in detail by the Executive Committee.

The Board approved the action of the Executive Committee in extending charters to the following Sections:

Montreal, Birmingham, Parkersburg, Seattle, Racine, and University of Western Ontario.

The President announced that Simon Collier had been assigned, as a specific duty for the ensuing year, the coordination of the efforts and activities of the five Society General Committees. A new system is to be followed by this Committee next year in accordance with an agreement reached at a meeting of their Chairmen. Contrary to past procedure, each Section will *NOT* be expected to appoint a representative to each of the five committees.

Program & Speakers: Will set up a small working group and use the various Section Vice-Chairmen as contacts.

Relations with Other Technical Societies: Will function in like manner.

Education & Training: Will set up a continuing committee with one member in each Region (approximately). Contacts by these men will possibly be through Section Vice-Chairmen also.

Membership: Will function in like manner.

Publicity & Promotion: Each Section should appoint a specific individual, but contacts will be from a small working committee.

Acknowledgment

The Board of Directors wishes to express its sincere appreciation to the Executive Committee, all Society Committees and Committee Chairmen, and to all Section Officers for the very fine work done during the year. The loyal support and contributions of time and effort by many individual members have importantly developed and strengthened our Society, and the Board acknowledges this with much thanks.

Cleveland, Ohio — For the Board of Directors
June 30, 1951 — WADE R. WEAVER, President

The meeting was followed by a Board of Directors Banquet given by the Fifth ASQC Convention Committee.

REPORT OF THE EXECUTIVE SECRETARY FOR THE 1950-51 FISCAL YEAR

At the end of the Society's first fiscal year on June 30, 1947, there were 25 active Sections of the Society and a total membership of 1926. How this has grown until the present time is illustrated in the following table:

Date	Membership	Active Sections
June 30, 1947	1926	25
June 30, 1948	2102	31
June 30, 1949	2638	35
June 30, 1950	3510	42
June 30, 1951	4224	48 and 1 provisionally accepted.

In addition, we have approximately 400 institutional subscriptions to INDUSTRIAL QUALITY CONTROL, making our total mailing list for the magazine approximately 4600.

The membership of the Society as of June 30, 1951 was composed as follows:

	New Members	Renewing	Total
Fellows	*	120	120
Senior Members	267	1131	1398
Members	1118	1564	2682
Total	1385	2815	4200
Members-in-Training	16	8	24
Grand total	1401	2823	4224

Exhibit A shows complete break-down of the membership into grades and Sections. By comparing this year's totals with those of June 30, 1950 it is to be noted that 94% of the 1949-50 Senior members and Fellows renewed their memberships in 1950-51, as compared with 73% of the Member grade members. 80% of the total 1949-50 membership

renewed in 1950-51, which is the highest rate in the history of the Society. Of the above-listed new memberships, the following were effective January 1, 1951: 107 Senior, 436 Member grade, and 3 Member-in-training. It will also be noted that the net increase in membership this year was 714, as compared with 872 for the 1949-50 fiscal year. This is a 20% increase, as compared with 33% last year and 25% the previous year. On June 30, 1951 we had received 167 1951-52 memberships, as compared with 58 1950-51 memberships on June 30, 1950. During the 1950-51 fiscal year there were 161 transfers from one Section to another.

New Sections recognized during the fiscal year in order of their recognition are as follows:

Birmingham - 44th Section
Parkersburg - 45th Section
Seattle - 46th Section
Racine - 47th Section
University of Western Ontario - 48th Section

Evansville Section was recognized provisionally, the proviso being that they have at least 25 members to be unconditionally accepted. The Rhode Island, Montreal and San Francisco Sections were recognized near the end of the 1949-50 fiscal year and first enrolled members as of July 1, 1951.

We have received requests for information on the procedure in organizing a Section from the following locations:

Mexico	State College, Pa.
North Carolina	Memphis, Tenn.
Martinsville, Va.	Kalamazoo, Mich.
Louisville, Ky.	Kansas City, Mo.
Lansdale, Pa.	Hawthorne, Nev.
Albany-Schenectady-Pittsfield	Buzzards Bay, Mass.
Wichita, Kans.	Dallas-Fort Worth, Tex
Richmond, Ind.	Huntsville, Ala.

Some of these prospective new Sections are still in the planning stage and some are almost ready to apply for affiliation with the Society. Lansdale is currently operating as a Sub-Section of the Philadelphia Section and has petitioned the Society to become a Section as of July 1, 1951. This petition is now up for action by the Executive Committee.

The office of the Executive Secretary continues to act as an employment clearing house between members of the Society and industry.

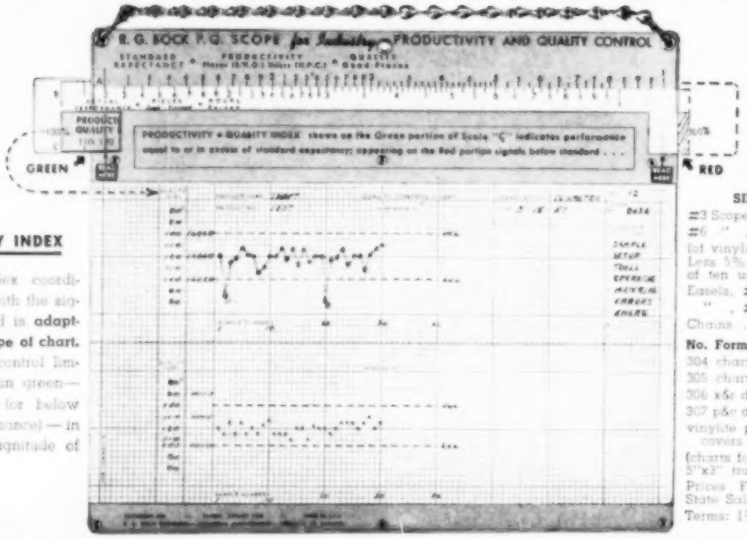
The Manual Covering Relationships between the Sections and the Office of the Executive Secretary has proved a great help to all concerned in standardizing procedures and generally increasing the efficiency of administration. The Manual was issued provisionally in October 1948. The first revised edition was issued in July 1949 and the second revision in February 1951.

We have set up a routine for the sale of membership pins to the members of the Society, and it is now operating smoothly. Members may secure pins through their Section Secretary, with the exception of members-at-large, who may secure them direct from the Executive Secretary.

The Society constitution was revised to include the amendments approved by the membership at the annual meeting in 1950 and printed in pamphlet form.

Watch your P's and Q's*—*for lower manufacturing costs!*

Located at Operator's Work Place or Machine


R. G. BOCK P. Q. SCOPE for Industry—PRODUCTIVITY AND QUALITY CONTROL
PRODUCTIVITY • QUALITY INDEX shows on the Green portion of Scale "C" indicates performance equal to or in excess of standard expectancy; appearing on the Red portion signals below standard . . .
GREEN
RED

For Productivity and Quality Incentives!

THE QUALITY INDEX

The quality index coordinates the chart with the signal arm—(C) and is **adaptable with any type of chart.** Plottings within control limits are signaled in green—out of control—(or below standard performance)—in red, showing magnitude of variations.

SIZES — PRICES

#3 Scope, 10"x3" Chart,	$5.00
#6 " , 10"x6" " ,	5.00

(of vinylite plastic rigid sheet)
Less 5% in standard packing of ten units.

Easels, #3	50c ea.
" , #6	65c ea.
Chains	25c ea.

No. Form	Size	100	500
304 chart	10"x3"	$1.50	$ 6.00
305 chart	10"x6"	3.00	12.00
306 x&c data sheets		3.50	14.00
307 p&c data sheets		3.50	14.00

vinylite plastic chart covers ..... each 50c
(charts fold to file in standard 5"x3" trays)
Prices F.O.B. Chicago, plus State Sales Tax
Terms: 1%—10 days.

The R. G. Bock P. Q. Scope provides for (1) **measuring** (2) **recording** (3) **signaling** productivity and/or the statistical quality level of a process. Exercises an added alerting influence upon operating personnel by bringing below standard performance into focus for corrective action, **while a job is running.**

Order direct from **R. G. BOCK ENGINEERS** • ***INDUSTRIAL MANAGEMENT*** ***Productivity and Quality**
Lincoln National Bank Building • 1951 Irving Park Road • Chicago 13, Illinois

The report of the Special Committee on Section Affairs was approved, and we arranged to have it printed in pamphlet form. It is now available for distribution. The report contains the following:

Suggested Basic Constitution for Sections
Manual for Section Officers and Committee Chairmen
Procedure for Use by Sections Governing Sub-Section Activities

During the latter part of the 1950-51 fiscal year the Executive Committee approved the purchase of the necessary equipment so that during the 1951-52 year (probably in October) we will be in a position to handle our own mailing. This will expedite the processing of new memberships and changes of address, and in addition should so improve our efficiency that the cost will be liquidated.

This will end my third and last term as Executive Secretary, and I wish to express my gratitude for the help that I have received from the membership of the Society whenever needed.

Respectfully submitted,

SIMON COLLIER,
Executive Secretary.

June 30, 1951

REPORT OF TREASURER

Appended hereto are Balance Sheet of the Society as of June 30, 1951 (Exhibit B), and Statement of Cash Receipts and Disbursements of the Society for the fiscal year July 1, 1950 through June 30, 1951, inclusive (Exhibit C).

Respectfully submitted,

ALFRED L. DAVIS, Treasurer,
Rochester, New York.

July 16, 1951

EXHIBIT B

AMERICAN SOCIETY FOR QUALITY CONTROL, INCORPORATED

Balance Sheet — June 30, 1951

Assets			
Cash:			
Current funds:			
Demand deposit	$15,741.58		
Time deposit	2,714.01		
Cash in transit from Convention Committee	15,869.67		
Petty cash funds	100.96	$34,426.22	
Special funds:			
Shewhart Medal Fund	$ 70.61		
Brumbaugh Award Fund	924.73	995.34	$35,421.56
Accounts receivable:			
Sale of reprints and back issues of Industrial Quality Control		$ 172.50	
Sale of technical literature and conference papers		121.80	
Library subscriptions		252.00	
Advance to 1952 Convention Committee		1,000.00	
Advertising and miscellaneous		219.10	1,765.40
Inventories—at nominal amounts:			
Back issues of Industrial Quality Control, reprints, and other technical literature		$ 1.00	
Stationery and supplies		1.00	2.00
Office furniture and equipment—at nominal amount			1.00
			$37,189.96
Liabilities and Surplus			
Accounts payable—sundry			$ 180.19
Deferred income:			
Membership dues paid in advance		$ 736.00	
Estimated unearned portion of library subscriptions		1,201.00	1,937.00
Reserves:			
For Shewhart Medal Fund		$ 70.61	
For Brumbaugh Award Fund		924.73	995.34
Surplus			34,077.43
			$37,189.96

EXHIBIT C

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS

AMERICAN SOCIETY FOR QUALITY CONTROL, INCORPORATED

Year ended June 30, 1951

CURRENT FUNDS

Receipts:			
Membership dues:			
Members-in-training	$ 74.00		
Regular members	16,000.97		
Senior members	11,571.09		
Fellows	1,425.83		
Overpayments	202.00	$29,273.89	
Less refunds of overpayments		250.50	$29,023.39
Publications:			
Advertising		$11,425.45	
Library subscriptions		2,329.40	
Sales of back issues		1,828.78	
Sales of reprints		365.80	15,949.43
Sales of Conference Papers and other technical literature		$ 761.31	
Less printing and other costs		315.99	445.32
Sales of Society pins		$ 823.27	
Less cost of pins		607.06	216.21
Interest received on bank deposit			26.93
Sales of cuts and insignia		$ 49.52	
Less cost thereof		34.84	14.68
Miscellaneous			25.07
TOTAL RECEIPTS			$45,701.03
Disbursements:			
Publications:			
Publishing—magazine		$12,092.51	
Publishing—News Supplement		940.15	
Printing—back issues and selected articles for resale		734.28	
Mailing supplies and expense—all publications		1,105.16	
Postage—all publications		1,141.81	
Office supplies and expense		87.08	
Secretarial service		1,255.00	
Advertising commissions and cash discounts allowed		938.72	
Traveling expense		546.36	$18,841.07
Committees and Sections:			
Printing costs—public relations material, reprints, stationery, etc		$ 92.46	
Postage		50.69	
Miscellaneous supplies and expense		178.16	
		$ 321.31	
Less reimbursements received from Sections		29.64	291.67
President:			
Office supplies and expense			183.65

Executive Secretary:		
Secretarial salaries	$ 5,194.51	
Printing and mimeographing	1,149.77	
Publishing 1950-51 Year-Book	1,938.84	
Mailing Year-Book	327.09	
Postage	442.50	
Office supplies and expense (including $825.19 for equipment)	2,606.13	
Office rent	750.00	
Traveling expense	173.14	12,581.98
Treasurer:		
Secretarial salary	$ 1,430.00	
Office supplies and expense	40.17	
Compensation insurance and bond premium	53.05	
Bank collection and exchange fees	14.07	
Traveling expense	252.23	
Postage	11.13	
Accounting service	200.00	2,000.65
General:		
Executive Committee expense		33.24
Advances to 1951 and 1952 Convention Committees	$ 2,000.00	
Less refund by 1951 Committee	1,000.00	1,000.00
Payroll tax expense for current and prior years		703.85
Income and social security taxes withheld from employees	$ 944.77	
Less payments made to Collector of Internal Revenue	944.77	-0-
TOTAL DISBURSEMENTS		$35,636.11
CASH RECEIPTS IN EXCESS OF CASH DISBURSEMENTS		$10,064.92
Cash on hand and on deposit at June 30, 1950		8,390.67
Cash on deposit at June 30, 1951		$18,455.59

SPECIAL FUNDS

Shewhart Medal Fund:

Receipts:	
Contribution by Metropolitan Section	$ 20.00
Interest received on bank deposit	1.76
	$ 21.76
Disbursements:	
Cost of striking three medals	122.40
CASH DISBURSEMENTS IN EXCESS OF CASH RECEIPTS	$ 100.64
Cash on deposit at June 30, 1950	171.25
Cash on deposit at June 30, 1951	$ 70.61

Brumbaugh Award Fund:

Receipts:	
Interest received on bank deposit	$ 9.66
Disbursements:	
Cash award to Irving W. Burr (May 23, 1951)	50.00
CASH DISBURSEMENTS IN EXCESS OF CASH RECEIPTS	$ 40.34
Cash on deposit at June 30, 1950	965.07
Cash on deposit at June 30, 1951	$ 924.73

REPORT OF AUDITING COMMITTEE

Ernst & Ernst, Certified Public Accountants, were retained to audit the books of the American Society for Quality Control, Inc. Relying on this audit and the certificate of Ernst & Ernst, we are of the opinion that the accompanying Balance Sheet and Statement of Receipts and Disbursements fairly present the financial position of the Society as of June 30, 1951, and its recorded cash transactions for the fiscal year ending that date.

Auditing Committee
HOWARD R. BOLTON
G. RUPERT GAUSE
PAUL A. ROBERT
JOSEPH R. SADOWSKI
HOWARD L. JONES, Chairman.

July 18, 1951.

CERTIFICATE OF AUDIT

American Society for Quality Control, Incorporated.

We have examined the balance sheet of American Society for Quality Control, Incorporated, as of June 30, 1951, and the statement of cash receipts and disbursements for the year then ended and, without making a detailed audit of the transactions, have examined or tested accounting records maintained by the Treasurer of the Society, and other supporting evidence as hereinafter outlined.

Cash on deposit at June 30, 1951 was reconciled with amounts reported to us by Lincoln Rochester Trust Company. We traced the recorded cash receipts for the fiscal year to deposits shown by bank statements on file, inspected reports made by the Executive Secretary in support of amounts recorded as having been received for membership dues, and tested other data on file supporting other recorded cash receipts. We also inspected canceled bank checks, invoices, and other data in support of the recorded disbursements for the year.

We examined data and checked computations supporting amounts shown in the balance sheet for accounts receivable, accounts payable, and deferred income at June 30, 1951.

In our opinion, based upon our examination as outlined above, the accompanying balance sheet and statement of cash receipts and disbursements present fairly the position of American Society for Quality Control, Incorporated at June 30, 1951, and the recorded cash transactions of the Society for the year then ended.

ERNST & ERNST.

July 11, 1951, Rochester, N. Y.

REPORT OF EXAMINING COMMITTEE

The Annual Report of this Committee was presented to the Executive Committee at its May 24, 1951 meeting. Summarized, it stated that of the persons recommended—or invited to transfer to the grade of Fellow—as of that date, 124 persons had accepted the grade of Fellow. (A complete list of all the above Fellow members appears in the 1950-1951 Year-Book.) The Committee submitted a list of persons it recommended be invited, or re-invited, to transfer to the grade of Fellow. Their recommendation will be acted upon by the Executive Secretary.

In accordance with a previous recommendation of the Committee, the list of those members assuming the grade of Fellow during the 1950-1951 fiscal year is as follows:

Niles H. Barnard
John N. Berrettoni
Gerald H. Cassady
Richard H. Ede
Joseph H. Ferri
Cameron E. Fisher
James A. Fizzell
G. Rupert Gause
Raymond W. Hanna
Leo R. Harrington
Lee R. Herndon
George V. Herrold
John C. Hintermaier
John W. Hood
John M. Howell
Dale L. Lobsinger
George W. McDermott
W. E. Marshall
Frederick Mosteller
Frank G. Norris
Walter S. Oliver
William R. Pabst, Jr.
Paul A. Robert
W. T. Rogers
Henry Scheffé
Hugh W. Smallwood
Edward S. Smith
O. Herbert Somers
John W. Tukey
Louis K. Vollenweider
Robert E. Wagenhals
Hugo A. Weissbrodt
Louis C. Young

The above 33 names, when added to the 92 names appearing in the September, 1950 issue of Industrial Quality Control, give a total of 125. One member has since resigned, leaving a total of 124 Fellows, as covered by the complete list appearing in the 1950-51 Year-Book.

REPORT OF EDITORIAL CHAIRMAN

The following report summarizes what is believed to be the important features in the experience of Vol. VII and the prospects for Vol. VIII.

Data on Vol. VII

In Vol. VII, IQC ran 3 issues at 40 pages, 2 issues at 48 pages, and 1 issue at 116 pages for a total of 332 pages. In addition, a 4-page Index of Vol. VI was published and inserted with each copy distributed of the July 1950 issue of Vol. VII.

Of the 332 pages published in Vol. VII, 95 represented paid ads (including Classified ads), leaving 237 pages for editorial copy. Of these 237 pages:

139 were used to publish 32 contributed papers, averaging $4\frac{1}{2}$ pages per paper and ranging from 1 6 to 20 pages in length;

36 were used for departmental copy, the breakdown here being as follows:

Bibliography:	each of the 6 issues
Book Reviews:	5 issues; vacated in Sept.
Practical Aids:	Sept., Jan., March, May
Problems Dept.:	Sept. only
ASQC News:	each of the 6 issues;

45 were used to handle Annual Reports, the Report of the 1950 Milwaukee Meetings, Advance Publicity on the 5th Annual ASQC Convention, and various miscellaneous Regional meeting publicity items and SQC courses publicity not conveniently allocable to the IQC News Supplement;

17 were used for miscellaneous items (covers, masthead, table of contents, and filler material).

Qualitatively, the 32 papers published in Vol. VII may be classified as follows:

General Interest	11
Sampling	4
Management	4
Non-Metallic Applications	5
Technical and Semi-Technical	8

The printing and mailing costs for the 6 issues of Vol. VII amount to about $12,900, a figure offset by some $10,000 net income from advertising. A more detailed record of income and expense including *all* publication activities of the Society is available in the Treasurer's Report.

Business Management

Through the vigorous and able efforts of Ray Saddoris, IQC qualified for a Second Class Mailing Permit during Vol. VII, an unbelievably difficult feat to accomplish.

Back issues of IQC are now being stored at the Cuneo plant in Milwaukee, an inventory of them has been compiled, and procedures have been set up for maintaining a running inventory on this asset.

Plans are now maturing to have the entire mailing operation for IQC maintained and managed at the Cuneo plant. This will effect further savings in mailing expense and further efficiencies in mail handling.

The regular paid advertising averaged 7.3 pages per issue in Vol. VII, with the *lowest* per-issue advertising space in this volume being at the *high point* for Vol. VI. Prospects for Vol. VIII appear to justify an expectation of about a 10-page per issue average, with 10.1/6 pages already committed for the July 1951 issue.

News Supplement

With the steady increase in number of local Sections of ASQC, the problem of managing a news reporting service for the Society has become increasingly complex and important. E. H. Robinson first proposed the idea of supplementing IQC in alternate months by a separate publication which would relieve our journal of the burden of managing a news service and also release space in it for more technical copy. Upon authorization by the Executive Committee, he accepted responsibility for editing a News Supplement and put out the Vol. I, No. 1 issue in June 1947. Since that time he has continued with conspicuous success to edit this valuable adjunct to IQC. His report covering the progress and problems of this publication and outlining plans for the future is given as a separate item under Annual Reports.

Rotation Plan for Editorial Board

The Editorial Board is now operating on a 5-year rotational plan which will be in full, automatic operation by July 1, 1955. Last year (June 1950) the Board roster was raised to 15 with the addition of E. L. Grant and Frank E. Grubbs. This year (July 1, 1951), Warren Purcell, Harry Romig and John Tukey will join the Editorial Board for a 5-year term, replacing Irving W. Burr, Churchill Eisenhart, and Wm. B. Rice. Your Editorial Chairman wishes herewith to express for himself and the Society the sincerest appreciation for the excellent cooperation and assistance rendered our publication activities by the three retiring members of the Editorial Board and to welcome into this service to the Society the three men who replace them.

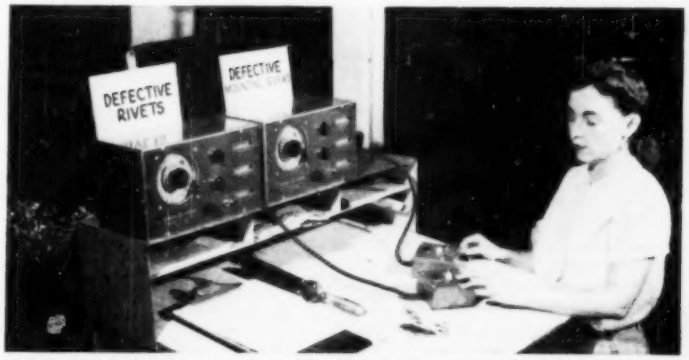
It is worth noting in this report that the first three Shewhart Medalists have been (and still are!) members of the Editorial Board and that the Brumbaugh Award this year went to still another member of this Board. These facts indicate conspicuously the calibre of men serving the Society in the important capacity of managing the editorial policy of its journal.

Manuscripts for IQC

There exist at present (May 21) only 10 fully processed papers as a backlog. This should carry us safely thru the Sept. 1951 issue because of holdover from May, special Convention material for July, and Annual Reports for the September issue.

New! GE

CONTINUOUS SAMPLING MONITOR



G-E Continuous Sampling Monitor used in plant of large eastern appliance manufacturer.

Insures Your Average Outgoing Quality Limit

Now you can keep track of complex inspection techniques with the Continuous Sampling Monitor . . . newest addition to the General Electric line of instruments developed to improve your quality control program.

By recording units accepted and rejected, the Continuous Sampling Monitor informs the inspector whether periodic sampling, or 100% inspection is required.

The AOQL (average outgoing quality limit) is thus insured by maintaining correct inspection techniques.

- **Ends "paperwork" by inspectors**
- **Reduces inspection time**

Look into the advantages of a Continuous Sampling Monitor. Try one on your production line and see how your quality control improves!

Contact your nearest G-E Sales Office, or write Sect. 687-77, General Electric Company, Schenectady, New York.

GENERAL ELECTRIC

687-77

There are 7 other papers still in process and a known potential of at least 10 others that are still in the "promissory" stage.

With 48 pages per issue as the goal for Vol. VIII, we shall need a steady supply of manuscripts in order to exercise the necessary selectivity to keep our journal on a high level of professional competence and reader value. It could easily happen that a scarcity of submitted papers might force our journal to publish virtually everything submitted, a circumstance clearly not conducive to the high standards we must have to bring IQC to the level of professional recognition we all want it to attain.

If we are to have a journal that professes to publish quality rather than quantity, we shall need incoming product in sufficient quantity to provide papers on a basis that will permit the exercise of increasingly higher standards of selectivity in choosing and processing those papers ultimately accepted for publication. We have been maintaining about a 5:2 ratio in favor of acceptances in the last two volumes. If our readers will concede any improvement in the editorial content of these last two volumes, it can be pretty successfully argued that such improvement is largely because we have had a sufficient supply of papers to justify this 5:2 ratio. Pulling this ratio closer to a 50-50 basis would certainly guarantee a progressively finer journal for ASQC.

Many fine papers that are logical candidates for IQC are leaking off to other publication sources or are in any event not being written up and submitted for consideration by our Editorial Board. In many instances this is fully understandable for various quite legitimate reasons, but it is nevertheless unfortunate. In the interests of strengthening our journal from the viewpoint of content, we urgently need the continuing support of our suppliers—the membership of ASQC. This support must be two-fold, viz.:

(1) A vigorous effort to see that good papers are written up and sent *first* to IQC for consideration.

(2) A willingness to understand that not every paper submitted can be accepted, even with revisions by the author, and once accepted cannot always be published on a time priority basis.

It is the function of the membership of ASQC to nurture its journal by praise where deserved, by constructive criticism where improvements can be made, and by maintaining a steady flow of grist for the mill in the way of manuscripts.

It is the function of the Editorial Board to set publication policy, to pass judgment on the acceptability of submitted manuscripts, and to recommend rejections or revisions of these papers.

It is the function of the Editorial Chairman to implement the wishes of ASQC membership regarding its journal so far as these wishes can be ascertained and are in harmony with publication policy as set by the Editorial Board, and to see that relations between contributors and IQC are maintained with tact, efficiency, and such promptness as circumstances will permit.

With such cooperation between the three vital components of our publication activity we shall be able to consolidate the gains we have made, correct the defects that have existed, and build into future volumes quality of performance, technical strength, and genuine reader interest and value.

Respectfully submitted,

MASON E. WESCOTT,
Chairman, Editorial Board.

May 26, 1951

NEWS SUPPLEMENT REPORT

Since the first issue of the NEWS SUPPLEMENT appeared in June 1947, local sections have been added steadily, but there has been no corresponding increase in the number of pages making up the SUPPLEMENT. Throughout this period, we have published a 4-page issue during the summer months of June and August, and 6-page issues in October, December, February, and April.

With this growth in the number of sections and yet maintaining a standard issue size from year to year, it has been necessary to become more and more selective in the choice of news material. Instead of publishing everything submitted, as was possible in the early life of the SUPPLEMENT, it became necessary to edit submitted material and retain only that which it was believed would be of interest to the greatest number of members.

As the NEWS SUPPLEMENT developed, new features were added. Election results soon became a regular feature of the NEWS SUPPLEMENT and took a large part of its available space in the June and August issues. Soon after, the Calendar became a regular issue feature and enabled us to condense into a comparatively small area announcements of coming meetings, conferences, and courses where there was not enough additional information to set the item up independently. More recently, the NEWS SUPPLEMENT has added articles on quality control activities in foreign countries, and also Positions Wanted and Positions Available. Most recently, personal items have been added and are being offered for comment in the August issue.

A study was made, covering the year 1950, of the frequency of local section meetings by days of the month. The frequency chart of these data showed a tri-modal distribution, with the central mode of a much greater magnitude. In terms of meeting dates, an appreciable number of local sections held their monthly meetings between the 5th and 7th, another appreciable group between the 26th and the 28th, but by far the large majority met during the third week of the month—between the 15th and the 21st. Since the publication plan had been to get the SUPPLEMENT into the hands of members during the last week of the month, it was obvious that the timing was poor. A change was accordingly made and the last two issues of the NEWS SUPPLEMENT have been mailed during the first week of the issue month. By following this revised procedure, the SUPPLEMENT will carry more pre-meeting information and possibly swell attendance at local section meetings.

Each local section is contacted for each issue of the NEWS SUPPLEMENT. A card is sent to both the section chairman and the reporter at least five weeks before the publication date, and they are reminded that news of their section activities should be submitted within ten days if they would like such news to appear in the next issue of the SUPPLEMENT. While all news subsequently submitted is edited, no news item is omitted unless it had been adequately covered in a previous issue.

Publication of the NEWS SUPPLEMENT on a monthly rather than a bi-monthly basis has been considered as a means of keeping in closer step with news items, particularly those dealing with coming events. The plan considered involved ten 4-page issues per year, omitting July and September and including a calendar page in each issue except June and August.

A thorough study of the matter revealed that this proposed policy would increase the costs by 40% with only an additional increase of 16% in space available for news. The plan was therefore temporarily shelved as uneconomical. Eventually, however, six pages will not meet our needs

and we shall then have to decide whether to go to a bi-monthly 8-page or to a monthly 4-page issue. It is believed this decision can be safely postponed until at least June 30, 1952.

As ASQC continues its healthy growth, its publications will grow with it. With this growth, demands on the time and effort of our editorial staffs will be greater. As far as the NEWS SUPPLEMENT in particular is concerned, your editor, who has been carrying this job single-handed, has already begun to feel the need for editorial help and would like to hear from any member who would be interested in assisting him. Such assistance would lead eventually, of course, to editorship of the publication.

Respectfully submitted,

ERNEST H. ROBINSON, Editor
IQC News Supplement.

July 16, 1951.

STOCK LIST
ASQC Publications

Publication	Price	Quantity
INDUSTRIAL QUALITY CONTROL Volumes I, II, III, IV, V, VI, VII (July 1944-May 1951)	$8.00 per Volume including Index	Unlimited
Individual Issues	$1.50 per copy	Unlimited
Library Subscriptions (Current)	$6.00 per year	.....
CONVENTION PROCEEDINGS "Abstracts of Papers" Third Annual Convention (41 Papers) Bound Volume	$1.50 per copy	100
"Convention Papers," Fourth Annual Convention (10 Separate Papers) Unbound	$ .30 per Paper $2.50 per set of 10 Papers	750
"Convention Transactions" Fifth Annual Convention (38 Papers) Bound Volume	$3.50 per copy	150
MISCELLANEOUS "Statistical Quality Control." A reprint of the article in *Fortune*, December 1949	$ .10 per copy OR $4.16 per 100 plus postage	3,000
"Hamilton Lot-Plot Plan." A reprint	$ .50 per copy	525
Proceedings, Middle Atlantic Regional Conference (16 Papers) Bound Volume	$2.50 per copy	65
ASTM Manual on Quality Control of Materials	$1.50 per copy	350

Make remittance payable to: American Society for Quality Control. Order from: American Society for Quality Control, Alfred L. Davis, Executive Secretary, 65 Plymouth Ave., South, Rochester 8, N. Y.

AMERICAN SOCIETY NEWS

SOCIETY WELCOMES NEW SECTIONS

New Sections of the Society are springing up in many areas; some may be called "off-shoots" from older Sections; some are entirely new groups. Latest additions to our family are:

1. RACINE (Wisconsin) SECTION, ASQC—Officials of this group are as follows: *National Director*—Sam Peters, Chief Inspector, Dumore Company, Racine; *Chairman*—E. W. Solum, Ass't. Chief Inspector of Hamilton Beach Div., Scovill Mfg. Co., Racine; *Vice-Chairman*—R. D. Hamacheck, Chief Inspector, Dynamatic Corp. Kenosha *Corresponding Secretary*—Joseph D. Peters, Director of Inspection, Belle City Malleable Iron Company, Racine; *Recording Secretary*—C. F. Ravencamp, Ass't. Chief Inspector, Massey Harris Co., Racine; *Treasurer*—Charles Cavanaugh, Chief Inspector, John Oster Mfg. Company, Racine.
2. SEATTLE (Washington) SECTION, ASQC—Officers are: *National Director*—Charles E. Ellis *Chairman*—Gordon P. Campbell *Vice-Chairman*—Terry E. Dalton *Secretary*—Paul T. Burdett *Treasurer*—Robert J. Phelps
3. UNIVERSITY OF WESTERN ONTARIO (Canada) SECTION, ASQC. Our third Canadian Section has selected the following officers: *National Director*—Mr. Fred Kennedy, Bendix-Eclipse Co. of Canada, Windsor; *Chairman*—Professor Brandt Bonner, University of Western Ontario, London; *Vice-Chairman*—J. B. Bassett, Timken Roller Bearing Co., St. Thomas; *Secretary*—R. Frank Lewarne, John Labatt Sta., London; *Treasurer*—Kurt P. Gladney, Fiberglas Canada Ltd., Sarnia
4. LANSDALE (Pennsylvania) SECTION, ASQC. This has been a Sub-section of the Philadelphia Section for a long time and has developed strongly to the point where it has become a full-fledged Section. Officers for the fiscal year 1951-1952 are as follows: *National Director*—F. C. Schulze, Hunter Spring Co., Lansdale; *Chairman*—Max Krissiep, Bethlehem; *Vice-Chairman*—Francis X. Brasch, Hunter Spring Co., Lansdale; *Secretary*—Alfred Bottke, Turnstedt Div., G.M.C., Trenton; *Treasurer*—Francis C. Henderson, North Wales, Pa.

It is a great pleasure to welcome these new Sections into our rapidly expanding Society which now totals 49 Sections. At least two other groups are in the imminent stages of becoming Sections as this goes to press.

CHANGES IN SECTION NAMES

Pursuant to the thinking that Sections are more appropriately named if their designation is somewhat spe-

cific rather than general, two Sections have changed their official names. Henceforth, the Ohio Section will be known as the CLEVELAND Section, and the Illinois Section as the CENTRAL ILLINOIS Section. It is anticipated that additional Sections will, where conditions indicate and permit, act similarly in altering their respective names.

GENERAL CONVENTION COMMITTEE

The Fifth National Convention at Cleveland brought out in many ways the many widespread and interlocking problems that confront the Society with respect to future National Conventions. The development of many new fields of interest imposes problems of gratifying the requirements of the individuals and industries involved; problems which can be satisfactorily solved only by careful planning. With an eye toward formulating adequate plans and coordination of the varied factors involved, the Executive Committee has set up the General Convention Committe as follows:

Wade R. Weaver, *Chairman*—1951
Martin A. Brumbaugh, Syracuse
Alfred L. Davis, Rochester
Robert C. Wagenhals, Canton
Leon Bass, Syracuse—1952
W. J. Masser, Philadelphia—1953

Each year the Chairman for the preceding Convention Committee will be dropped and the Chairman of the next ensuing Convention will be added, thus providing both experience and continuity to the General Committee. At least three representatives of the National Society will serve on a continuing basis. It is felt this will provide a group to adequately handle the largest single activity of the Society and certainly one of its most important ones.

AUTOMOTIVE TECHNICAL COMMITTEE

As announced in the July issue, Mr. Nelson G. Meagley, Manager of Statistical Quality Control at Willys-Overland Motors, Toledo, Ohio, has been appointed Chairman of the Automotive Technical Committee. This group has developed an active program, has set up several subcommittes on specific problems, and is looking for interested individuals willing to contribute their share of effort. Interest in SQC on the part of the automotive field is growing rapidly, and this Committee occupies a position of great importance in the Society's technical activities.

CONSTITUTION & BY-LAWS COMMITTEE

Mr. George D. Edwards, framer of our original Constitution, assumed the Chairmanship of this Committee on July 1, 1950. The Society is most fortunate in having a member with such interest and ability on constitutional matters to carry on the work of keeping our Society's governing documents abreast of its developments. The initial charge to the Committee for 1951-1952 has been made as a result of action by the Board of Directors, reported elsewhere in this issue.

EXECUTIVE COMMITTEE MEETS

The Executive Committee held two sessions during the Convention period—one on May 22 and one on May 24. Items of discussion included the customary review of the membership situation, financial position and publications examination, as well as several special topics. In addition to those reported on specifically in other portions of ASQC News Items, the following are of interest:

The "Territorial Revisions Committee" appointed by Past President Wareham to explore the complex situation involving Regions, Regional Directors, National Directors, etc., in view of the limitations in our Articles of Incorporation to fifty National Directors, and the top-heavy administration problems, was thanked for their services and dissolved. Replacing this Committee, the "Section Representation Committee" was appointed, consisting of:

Arthur Bender—Indianapolis Section
Martin A. Brumbaugh—Syracuse Section
George D. Edwards—Metropolitan Section
A. C. Richmond—Chicago Section
Wade R. Weaver, *Chairman*

This Committee was instructed to "review the work of the previous Committee, examine the present setup of National Directors, and resultant administrative problems, and to submit to the Executive Committee a plan for simplification."

The Executive Committee passed a resolution—in view of the approval by the membership of the revision to the Constitution to comply with the intent of permitting more than one Vice-President—to recommend to the Board of Directors for their consideration the following:

(a) That the President instruct the Nominating Committee to prepare nominations for three Vice Presidents for the 1952 Election of Officers, and

(b) That the President instruct the Constitution & By-Laws Committee to prepare the required changes in wording of the Constitution to comply with the intent as approved by the membership; and specifically that: (1) all the Vice-Presidents be of "equal rank"; (2) that in the event of the necessity of a replacement for the President, the Executive Secretary shall call a meeting of the Executive Committee, which body shall determine which of the Vice-Presidents shall replace the President; (3) that the duties of the several Vice-Presidents shall be spelled out and that they shall be the same as the duties of the President; (4) that the President shall assign the duties of the Vice-Presidents on a pre-arranged and announced plan; (5) that the Constitution and By-Laws Committee shall present their recommended revisions to the Executive Committee to make certain their intent (as above) has been complied with, following which the entire matter is to be referred to the Board of Directors for action. (The Board of Directors, at its meeting on May 25, approved the recommendation of the Executive Committee, without change.)

The resignation of Charles J. Hudson as Assistant Executive Secretary, made necessary by the unusual press of business connected with the present National emergency situation, was accepted with considerable regret.

The bid of the Metropolitan Section to hold the 1955 National Convention in New York City was received and referred to the General Convention Committee, approval being recommended. (The bid has since been officially accepted and the Ninth National Convention committed to New York City.)

The President appointed Paul A. Robert and Raymond S. Saddoris as a committee to examine and recommend procedure for clarifying the duties of the Nominating Committee as expressed in the Constitution.

At the express request of a specific Region the general subject of "A Better Geographical Distribution of National Officers" was discussed. It was the unanimous agreement that this subject could best be handled by a Special Committee selected for

the purpose, and the President was instructed to so proceed.

The reports of the Executive Secretary and the Treasurer have been extended to complete the fiscal year ending June 30, 1951, and are published elsewhere in this issue.

ANNUAL MEETING—1951

The Annual Meeting of the Society was held in the Cleveland Public Auditorium on May 23 and 25, 1951, in three separate sessions.

President Weaver called the first session to order at 4:30 P. M. on May 23, after affording an opportunity for any last minute ballots to be proffered to the Executive Secretary. A Tellers' Committee was appointed as follows:

Paul C. Clifford, *Chairman*
J. Fred Verigan
William A. MacCrehan
Warren P. Jones
Philip B. Proctor
William P. Goepfert

Instructions were given this Committee in connection with the voting for election of officers and the amendment to the Constitution, following which the first session was adjourned.

The second session was convened just prior to the close of the Annual Banquet on May 23, 1951—President Weaver calling for the report of the Tellers' Committee. Chairman Clifford reported as follows:

1. A total of 1,953 ballots were cast, or 47.7% of the 4,084 qualified to vote.
2. *Election of Officers:* The requisite number of valid ballots were cast and more than the required percentage of the total qualified ballots cast were in favor of the following:
   President—Wade R. Weaver
   Vice-President—Simon Collier
   Secretary—Alfred L. Davis
   Treasurer—Paul A. Robert
3. *Amendment to the Constitution:* The requisite number of valid ballots were cast and more than the required percentage of the total qualified ballots cast were in favor of the Amendment. This was an amendment to permit the Society to have more than one Vice-President at the discretion of the Board of Directors; details of duties, etc., to be subsequently worked out by the Board.

The President thereupon declared the election valid, the above officers officially elected, and the Constitutional Amendment adopted. The Tellers' Committee was discharged with thanks, and the second session of the Annual Meeting was then adjourned.

The third session was convened at 10:00 A.M., May 25, 1951, at the Hotel Cleveland.

The President presented the Report of the Board of Directors to the Society for the fiscal year 1950-1951, summarizing Society activities by a condensed digest of the reports of the Chairmen of the various Society Committees. Reports were presented by the Executive Secretary, the Treasurer, and the Chairman of the Editorial Board in person. All these reports were duly approved. These reports have been extended to cover the complete fiscal year, and are published in full elsewhere in this issue of the magazine.

Opportunity was afforded for any other items of business to be advanced; none being forthcoming, the meeting was adjourned.

COMMITTEE ON SECTION AFFAIRS

The Committee submitted to the Executive Committee the following three documents for their consideration as "model" documents, to be offered to Sections for their guidance:

1. Model Section Constitution
2. Model By-Laws governing Sub-Section affiliation
3. Model Section Officers' Manual

These were reviewed, minor suggestions offered, accepted and incorporated, and turned over to the Executive Secretary for preparation for distribution. They will appear as one booklet and are now available upon request from the Executive Secretary. They are not to be considered as mandatory, but are merely offered as helpful guidance.

ASQC MEMBERSHIP QUALIFICATIONS

Because of recurring misunderstandings on qualifications for membership in the American Society for Quality Control, the Society Committee on Professional Ethics and Qualifications has recommended that these be published exactly as they appear in the Constitution. They are presented herewith in compliance with that recommendation. It will be noted that Senior and Fellow grades are strictly professional in character; Honorary grade is strictly honorary in character.

ARTICLE II—MEMBERSHIP

Section 2. Grades:

The corporate membership of the Society shall consist of Members, Senior Members, Fellows and Honorary Members. Corporate members shall be equally entitled to all the rights and privileges of the Society.

Section 3. Members:

Any person of good character who has attained the age of twenty-one (21) years and who is engaged in or interested in quality control work shall be eligible for the grade of Member in the Society.

Section 4. Senior Members:

A Senior Member shall be not less than twenty-seven (27) years of age, and shall be either:

a. A quality control or inspection engineer, or the equivalent thereof, by profession. As such, under general direction, he shall have planned and taken responsibility for important engineering or inspection work requiring application of the principles of quality control, and he shall have been in the active practice of his profession for at least five (5) years. If he holds, in one or more principal national societies of other branches of engineering, membership of a grade for which the qualifications indicate a standing in those branches equal to that required for Senior Member herein, such membership shall be considered the equivalent of two and one-half ($2\frac{1}{2}$) years of the requisite five (5) years in active practice of his profession. If he has had years of teaching experience, as defined in Section 4. b. of this Constitution, one-half of those years shall be considered as equivalent years of quality control practice.

b. A teacher of quality control, of engineering or statistical methods as applied to quality control, or of closely allied subjects. As such, under general direction, he shall have taken responsibility for instruction in such subjects in a school of recognized standing, and he shall have been in the active practice of his profession for at least five (5) years. Any years of experience as defined in Section 4. a. of this Constitution, that he may have had, shall be considered as the equivalent of the same number of years as a teacher of quality control.

c. A person regularly engaged in quality control or in closely allied work for at least five (5) years, who, by the working out of quality control principles and procedures, or by proficiency in quality control, statistics or closely allied subjects, or as an executive of a production or operating enterprise of large scope, has attained a standing equivalent to that required for Senior Members under Section 4. a. or Section 4. b. of this Constitution. In the case of an executive, he must be qualified to

take responsible charge of the broader phases of quality control in the work under his direction.

Section 5. Fellows:

A Fellow shall be not less than thirty-three (33) years of age, and shall be either:

a. A quality control or inspection engineer, or the equivalent thereof, by profession. As such, he shall be qualified to plan and to take full and responsible charge of important quality control work. He shall have been in the active practice of his profession for at least ten (10) years, and shall have had full and responsible charge of important quality control work for at least three (3) years. If he holds, in one or more principal national societies of other branches of engineering, membership of a grade for which the qualifications indicate a standing in those branches equal to that required for the grade of Fellow herein, such membership shall be considered equivalent to five (5) of the requisite ten (10) years of active practice in quality control work. If he has had years of teaching experience as defined in Section 5. b. of this Constitution, one-half of those years shall be considered as equivalent years of quality control practice.

b. A professor in quality control or in an allied subject. As such, he shall have attained special distinction as an expounder of the principles of quality control or of closely allied statistical or inspection subjects. He shall have had at least ten (10) years' experience as a teacher of quality control or of allied subjects, and shall have had full and responsible charge for at least three (3) years in a course involving quality control in a principal college or engineering school. Any years of experience as defined in Section 5. a. of this Constitution, that he may have had, shall be considered the equivalent of the same number of years of experience as a teacher of quality control.

c. A person who has done notable original quality control work of a character to give him a recognized standing equivalent to that required for Fellows under Section 5. a. or Section 5. b. of this Constitution.

Section 6. Honorary Members:

An Honorary Member shall be one who has rendered acknowledged eminent service to quality control.

Section 7. Education:

In all cases, the holding of a degree from a college or engineering school of recognized standing shall be considered the equivalent of one (1) year's quality control experience for the purposes of Section 4 and Section 5 of this Constitution.

MEMBERSHIP

The Membership Committee met at the Convention to review the progress made during the past year. Of the 3,510 members on record for 1950 we lost 702 for various reasons.

Prompt action in the Sections may prevent the loss of many members due to delinquency and resignation. Organize to reduce this annual loss in your membership. Personal contact is the *best* remedy. Members can help the Section by *paying their dues promptly*. Please cooperate. It is one way in which a member can show appreciation for the good job the Section Officers are doing.

Good leadership is essential to the growth of each Section. Good leadership will always attract and *hold* a progressive group in a field of common interest. The committee appeals to the officers of the Section to be good leaders, to select dynamic committees on membership, then encourage these committees to develop progressive plans for *holding* the present members and attracting new members who can benefit by association with our Society.

The Membership Committee for 1952 will be comprised of the following men:

R. S. Inglis, *Chairman*
E. T. Terhune, *Vice-Chairman*
H. Hamilton, *New England Region*
F. W. Wehrfritz, *Middle Atlantic*
L. E. Coger, *Northern*
H. S. Bayer, *Central*
J. Riegert, *Midwest*
D. E. Moosman, *Western*

REMINDER

The Constitution of ASQC (Section 23) specifies that corporate members remaining in arrears after October 31 "shall receive no further Society publications".

Much confusion, delay in receiving IQC and its News Supplement, extra work and expense to the Society, etc. can be avoided if each member will

(1) make sure he has paid to his local Section officers his dues for 1951-52, and

(2) check with the officers of his local Section to make sure his membership and national dues have been transmitted to the Executive Secretary's office prior to October 31.

CONSULTING SERVICES

Responsibility of the American Society for Quality Control, Inc., for Consulting Services advertising is limited to certification that advertisers hold the grade of membership in the Society stated in their advertisements. Qualification requirements for the several grades of membership are set forth in the Constitution of the Society.

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POSITIONS AVAILABLE

QUALITY CONTROL ENGINEERS—Well established Eastern manufacturer of precision products has openings for following: *Senior Quality Control Engineers*—M.E. or I.E. experienced in testing and inspection methods and SQC; to supervise industrial investigations and quality methods improvement. *Junior Quality Control Engineers*—preferably with technical education and some experience along above lines. Opportunity for advancement and interesting work in modern Quality Control Department. Send complete resume, including past earnings and salary requirements to 8G1 American Society for Quality Control, Room 5036, 70 East 45th Street, New York 17, N. Y.

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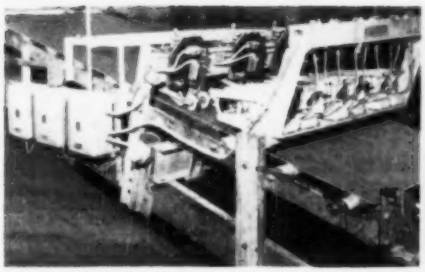
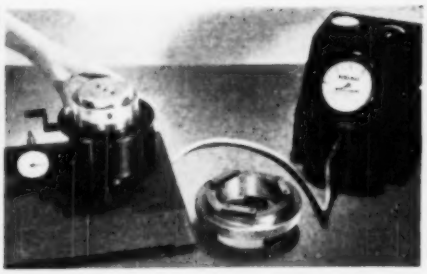


Continuous Measuring Gage checks thickness of hard board sheets . . . automatically marks defective areas.



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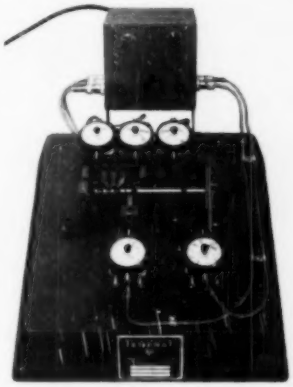

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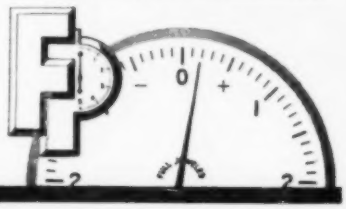
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